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SIX DEGREE OF FREEDOM FORTRAN PROGRAM, ASTP DOCKING DYNAMICS, USERS GUIDE

ROCKWELL INTERNATIONAL CORP., DOWNEY,
CALIF. SPACE DIV

JUN 1974

CONTRACT NAS9-13100

SD 74-CS-0023

SIX DEGREE OF FREEDOM FORTRAN PROGRAM "ASTP DOCKING DYNAMICS" USERS GUIDE

JUNE 1974

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ABSTRACT

Documentation of the digital program "ASTP Docking Dynamics" is intended to aid the engineer using the program to determine the docking system loads and attendant vehicular motion resulting from docking two vehicles that have an androgynous, six-hydraulic-attenuator, guide ring, docking interface similar to that designed for the Apollo/Soyuz Test Project (ASTP). In its present form, the program is set up to analyze two different vehicle combinations: (1) the Apollo CSM docking to the Soyuz and (2) the Shuttle orbiter docking to another orbiter. The subroutine "RCS" modifies the vehicle control systems to describe one or the other vehicle combinations; the rest of the vehicle characteristics are changed by input data.

To date, the program has been used to predict and correlate ASTP docking loads and performance with docking test program results from dynamic testing conducted at NASA JSC in Houston. The program was written by Mr. John A. Schliesing, of NASA JSC, and modified for use on IBM 360 computers. Parts of the original docking system equations in the areas of hydraulic damping and capture latches were modified so that they may better describe the detail design of the ASTP docking system.

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ILLUSTRATIONS

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INTRODUCTION

This user's guide documents the "ASTP Docking Dynamics" Fortran-H computer program. The program computes docking system loads, vehicle loads, kinematics of the particular docking system design used in the Apollo/Soyuz test project, and motion of docking vehicles in response to docking loads and vehicle control system activity from the point of initial docking contact through capture latch activation and eventual draw down. The program does not include hard structural latching or hard docking dynamics.

The program treats the two vehicles and docking ring as rigid bodies each with six degrees of freedom and a structurally compliant and hydraulically attenuated docking interface between the ring and the active vehicle. The program output is in real time print and optional time history plots of loads and motion of the docking system and both vehicles.

The basic program was written for UNIVAC by NASA and modified by J. Rolley, L. Fesler, and B. Mikhalkin to be compatible with IBM O/S 360 Model 85 computing equipment at the Space Division of Rockwell International.

PROGRAM DESCRIPTION

The "ASTP Docking Dynamics" program is recorded on nine-track magnetic tape and is available from the Rockwell Space Division computer library by calling for the mounting of tape UH9552 in the JCL cards. The program listing, source decks, and object decks are retained in Department 214, Group 420, for possible future modification and as a backup for the library tapes. The last two sections of this document contain program flow diagrams and locations of primary functions to aid the engineer in troubleshooting or finding where modifications to equations may be made.

DOCKING SYSTEM

The docking system described mathematically in the "ASTP Docking Dynamics" program is presented in Figure 1. The passive or target vehicle docking system is presented in Figure 2. The docking mechanism concept is a tunnel with peripheral shock absorbers connecting an androgynous floating interface. The androgynous feature of the docking interface is provided by a symmetrical distribution of guides and capture latches on the active vehicle guide ring. During docking they are meshed with the reverse symmetry guides on the passive vehicle guide ring. The guide ring of the active docking system is extended from the structural base ring on six hydraulic attenuators in preparation for docking. The passive system guide ring remains retracted. Extention is by springs inside the attenuators. Initial contact is made between guides and guide rings. Miss distance and angular misalignments are indexed into alignment by the guides. Once the guide rings are coincident, the active system capture latches engage the passive vehicle's body-mounted latches for initial mechanical connection of the two docking vehicles. Attenuator hydraulic damping and extend springs control the relative motion of the two vehicles. Once the vehicles are stabilized, the active system cable retract mechanism is activated, and the two vehicles are drawn together until the structural base rings and docking tunnel seals engage. Structural ring latches are then actuated to provide a rigid structural interface between the now hard-docked vehicles.

The "ASTP Docking Dynamics" digital program can duplicate all the operations for docking except tunnel sealing and structural ring latch.

Presented in Figure 3 are the coordinate systems and vector directions used to describe the docking systems relationship with respect to each vehicle and the inertial frame. Each vehicle and the active docking system guide ring are represented as bodies with point mass. The order of rotation to resolve one body's axies system into another is shown on Figure 4.

VEHICLE GEOMETRY

To date, two different vehicle combinations have been simulated for docking loads and dynamic analysis. Figure 5 shows the vehicle geometry of

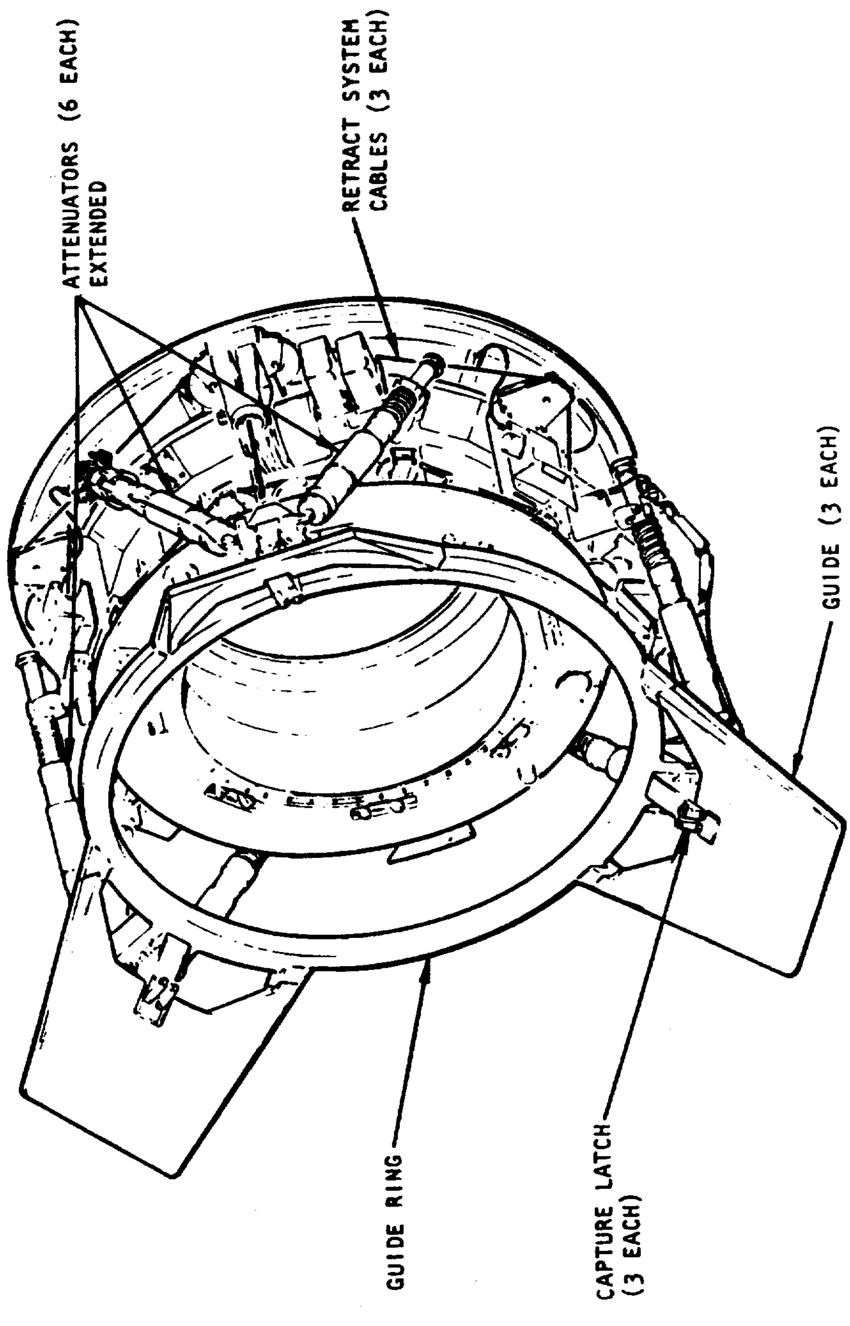


Figure 1. Active Vehicle, Active Docking System

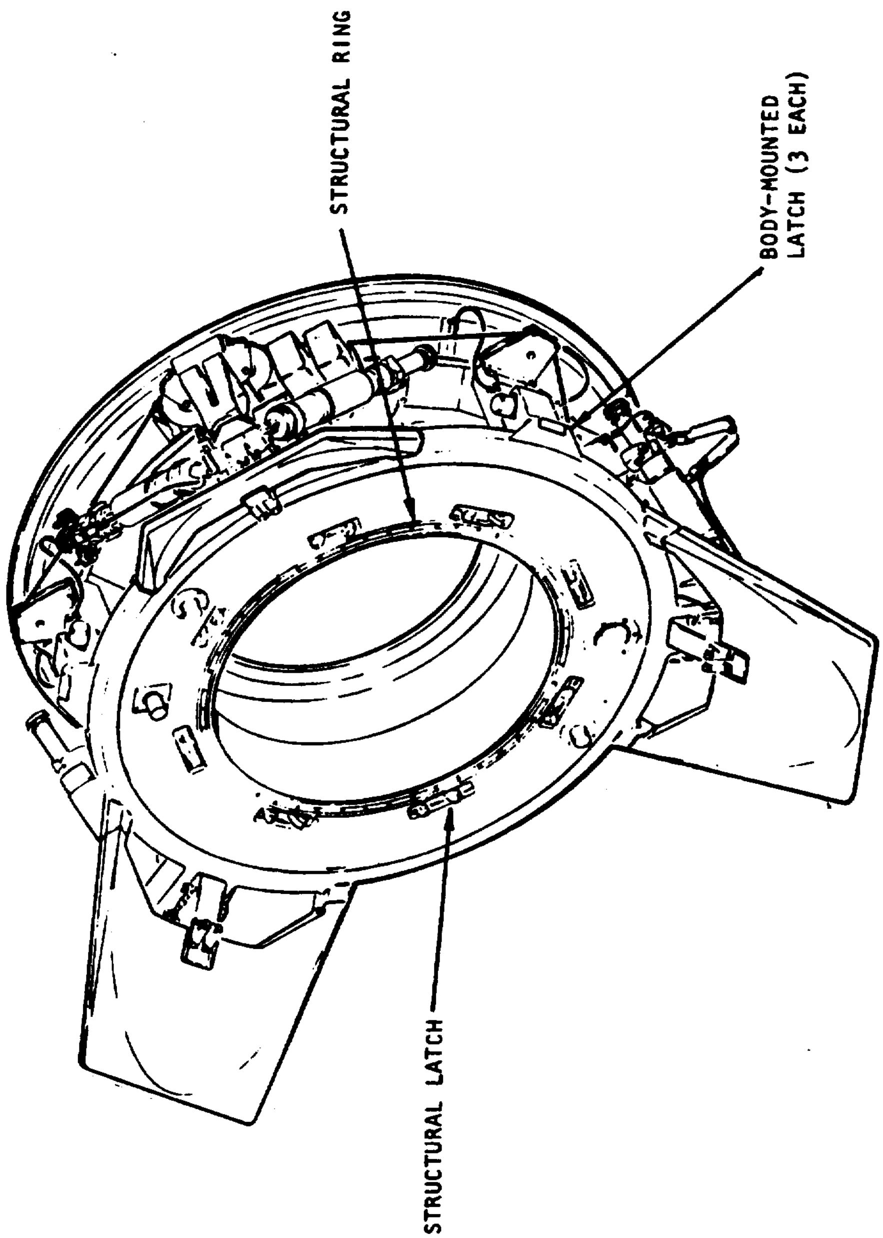


Figure 2. Target Vehicle, Passive Docking System

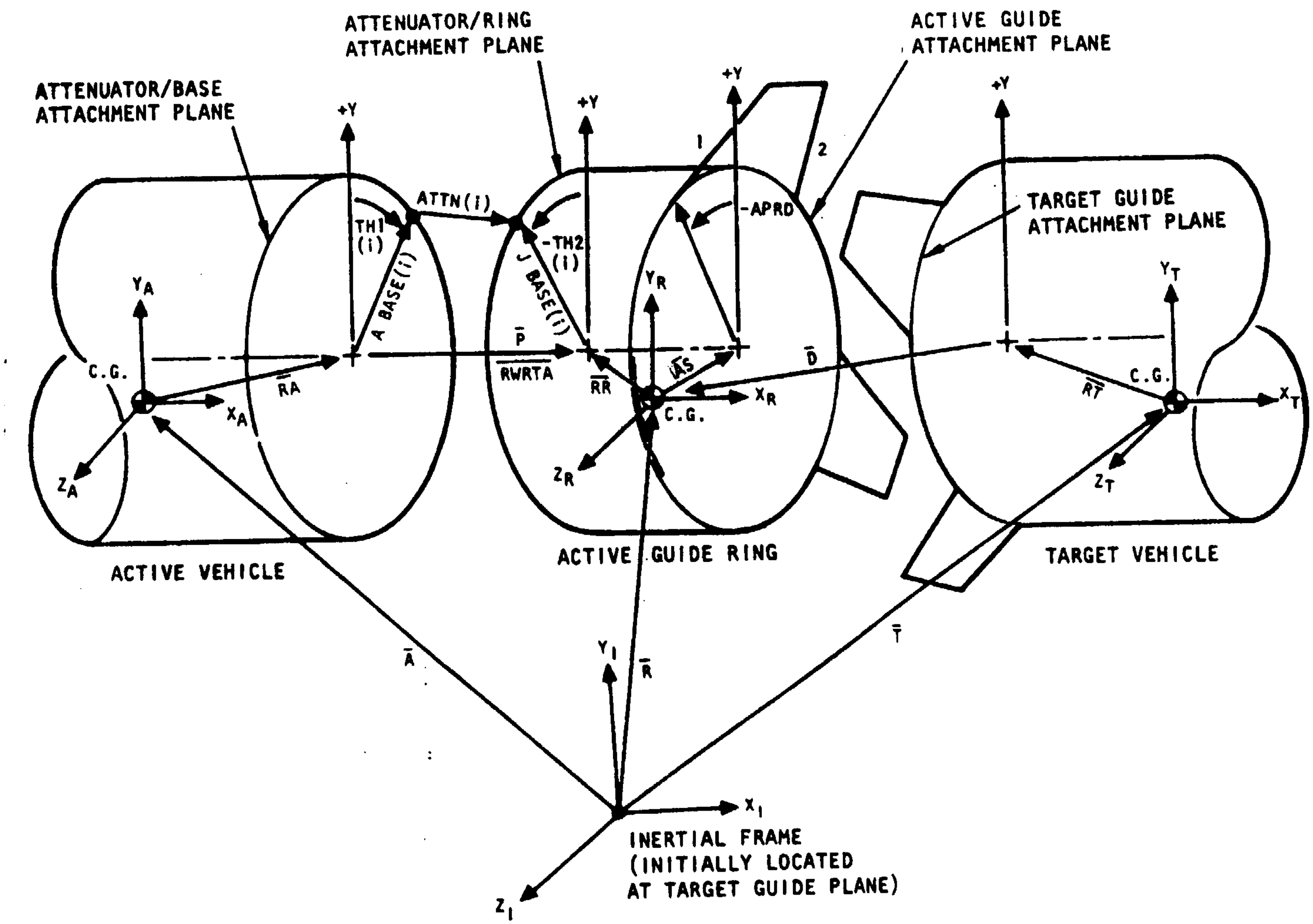


Figure 3. Docking Math Model Coordinate Systems

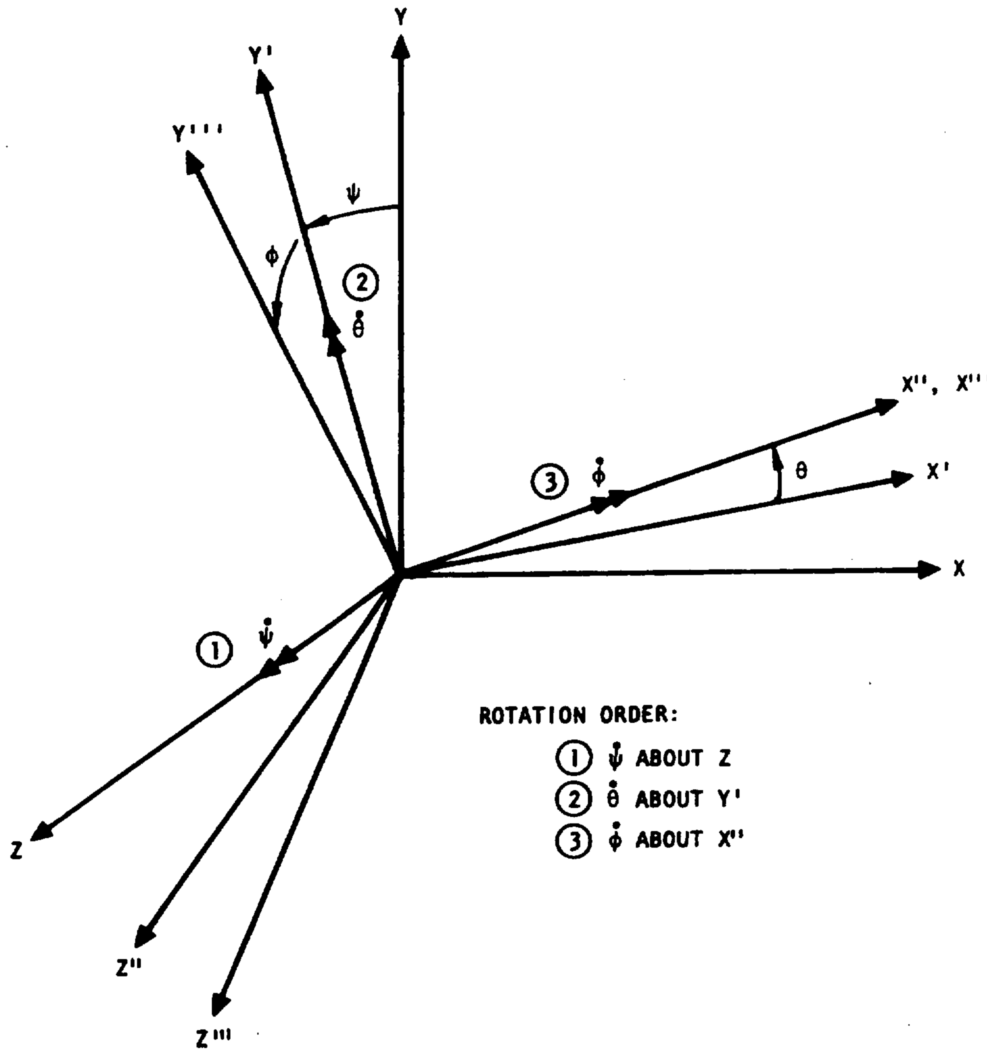


Figure 4. Euler Angle Rotations

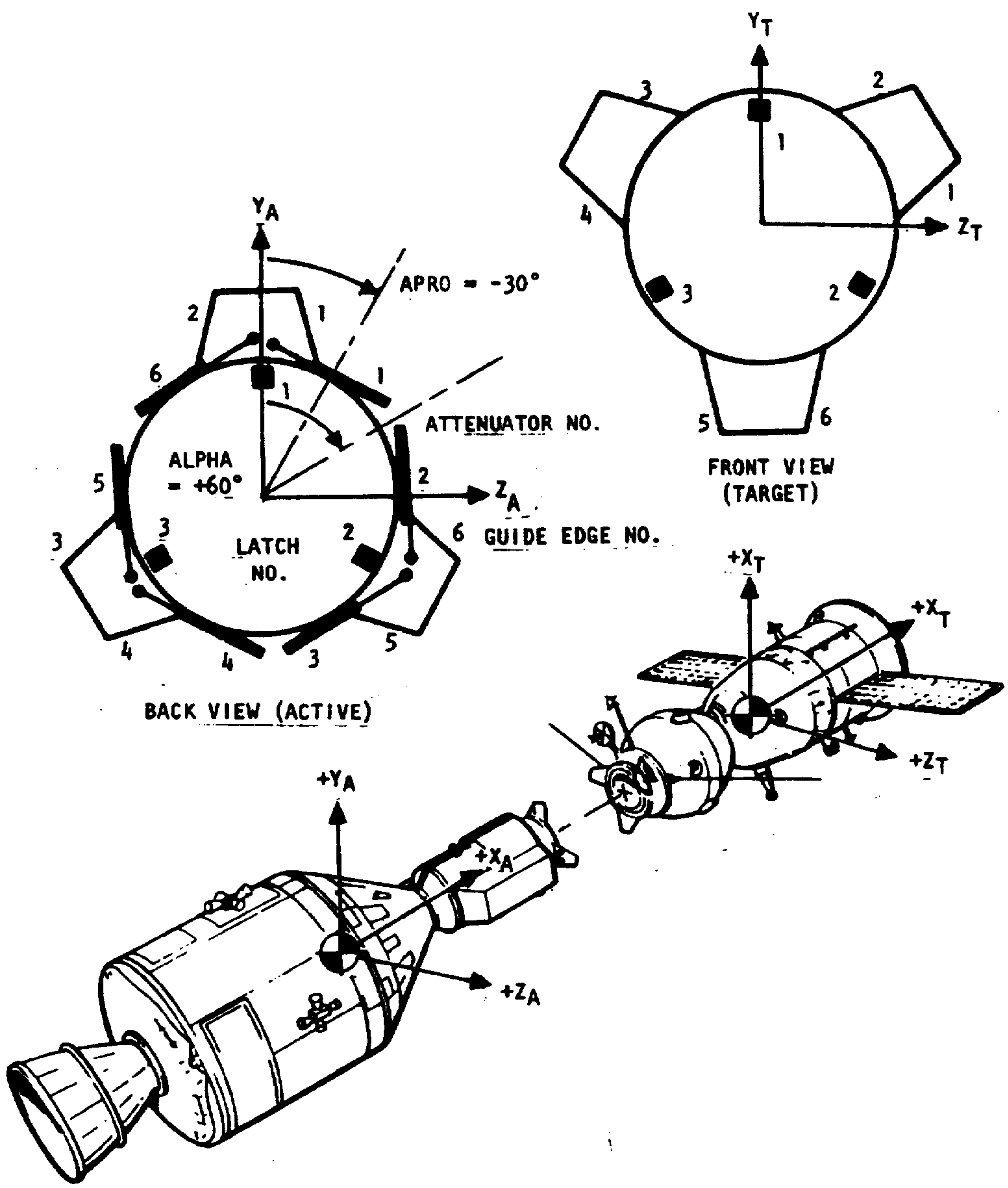


Figure 5. Apollo CSM/Soyuz Docking Model

the Apollo CSM docking with the Russian Soyuz spacecraft. Figure 6 shows the Shuttle orbiter docking with another orbiter. In each instance, the docking system is parallel with the X axis as required by the math model. This requires the user to rotate mass properties of the vehicles to the axis system used by the math model. Notice that the guide location with respect to the +Y axis in each instance is different depending on the values assigned to the geometry input APRO and ALPHA.

VEHICLE CONTROL SYSTEMS

The "ASTP Docking Dynamics" program includes reaction jet control systems for three different vehicles: The Apollo CSM, the Soyuz spacecraft, and the orbiter. All three are basically attitude and rate-feedback control systems that activate specific combinations of reaction jets which generate pitch, yaw, and roll moments. These moments counteract any external forces, like docking, in an attempt at maintaining a particular inertial attitude.

In addition to attitude hold, the control system may be commanded to provide closing thrust of translation jets oriented parallel to the X axis of each vehicle. Closing thrust is cued by time after contact and terminated at some specified time after capture latch engagement of the docking system.

The attitude-hold control system of either vehicle can be switched to the "rate damping only" mode or into the "free" (no control) mode at some specified time after docking capture latch engagement.

The attitude-hold control system is of the general form shown in Figure 7 and is common to all three axes of rotation on all three vehicles. Figures 8, 9, and 10 present the reaction control jet configuration activated by the control systems for the CSM, the Soyuz, and the orbiter.

At present, the control systems are defined in subroutine "RCS." However, there are two models of this subroutine. One describes the CSM and Soyuz, and the other defines orbiter-to-orbiter control system configurations. A modification to the program is being planned to include both RCS subroutines with a call symbol to define which one is desired.

EQUATIONS OF MOTION

Time-dependent equations of motion, oriented with respect to a body-axis system in an inertial frame (nonprincipal) for three bodies, i.e. active vehicle, docking ring, and passive vehicle, are from the classic Newtonian mechanics found in any good dynamics text or in engineering handbooks such as "Marks' Mechanical Engineers Handbook." The generalized equations are of the position, velocity and acceleration form as follows:

$$r_o = r_q + r$$
$$V_o = V_q + r_\omega + V$$
$$a_o = a_q + r(\dot{\omega} + \omega^2) + 2V\omega + a$$

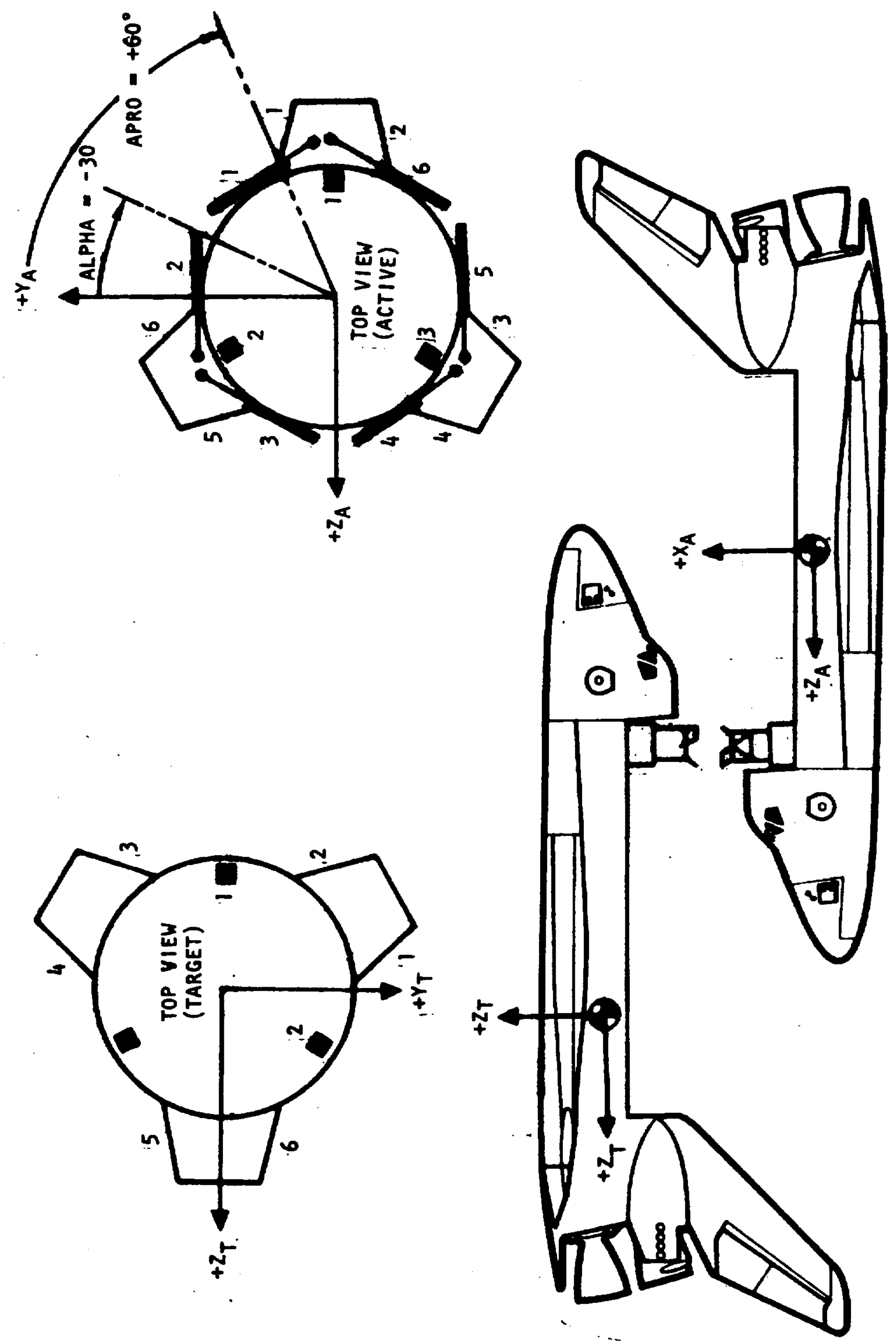


Figure 6. Shuttle Orbiter/Orbiter Docking Model

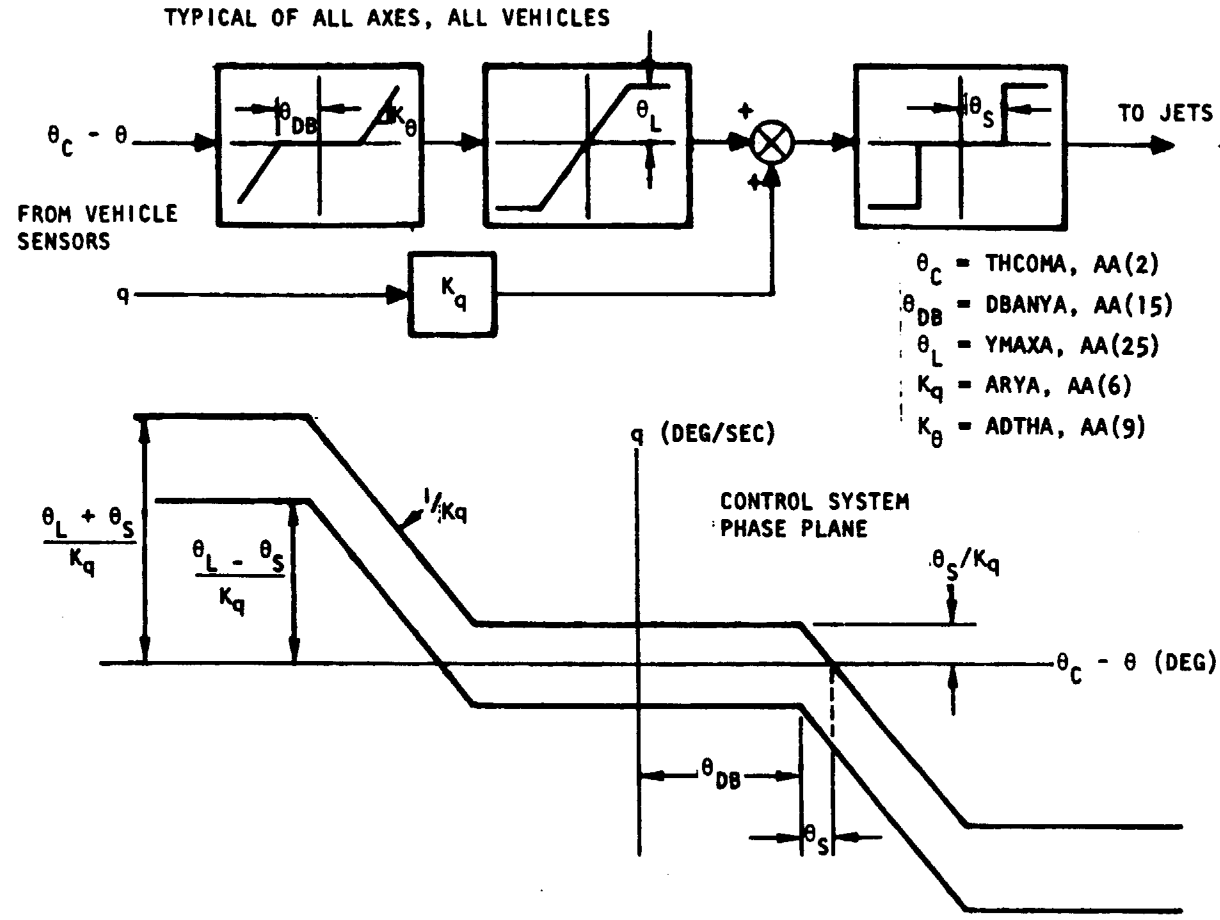


Figure 7. Attitude Hold Control System Characteristics

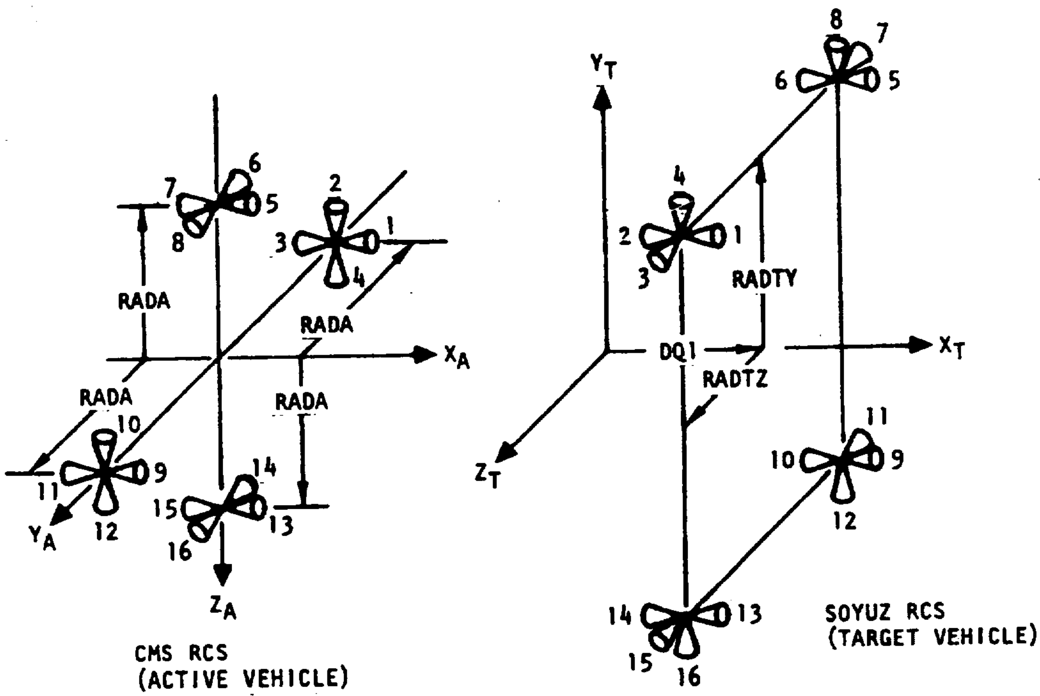
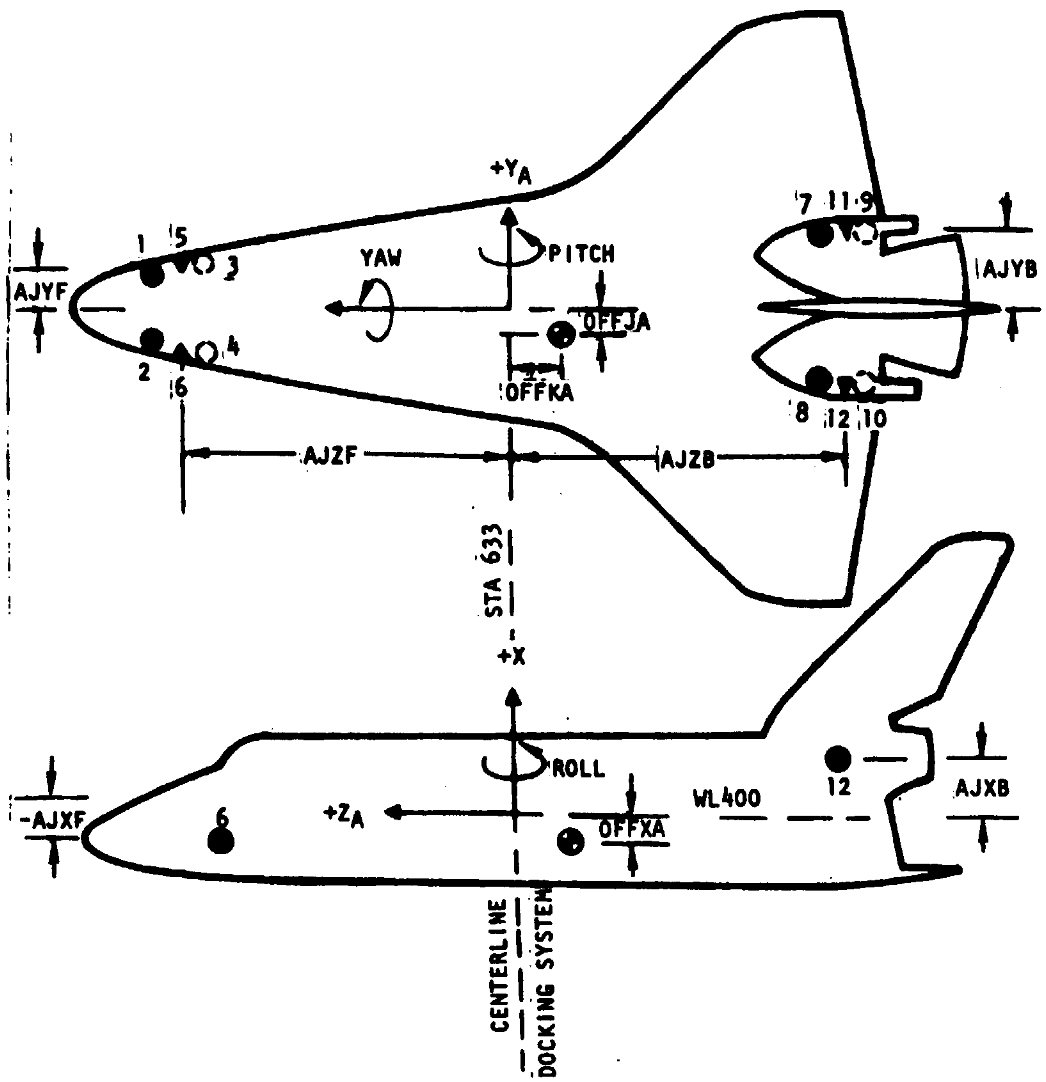
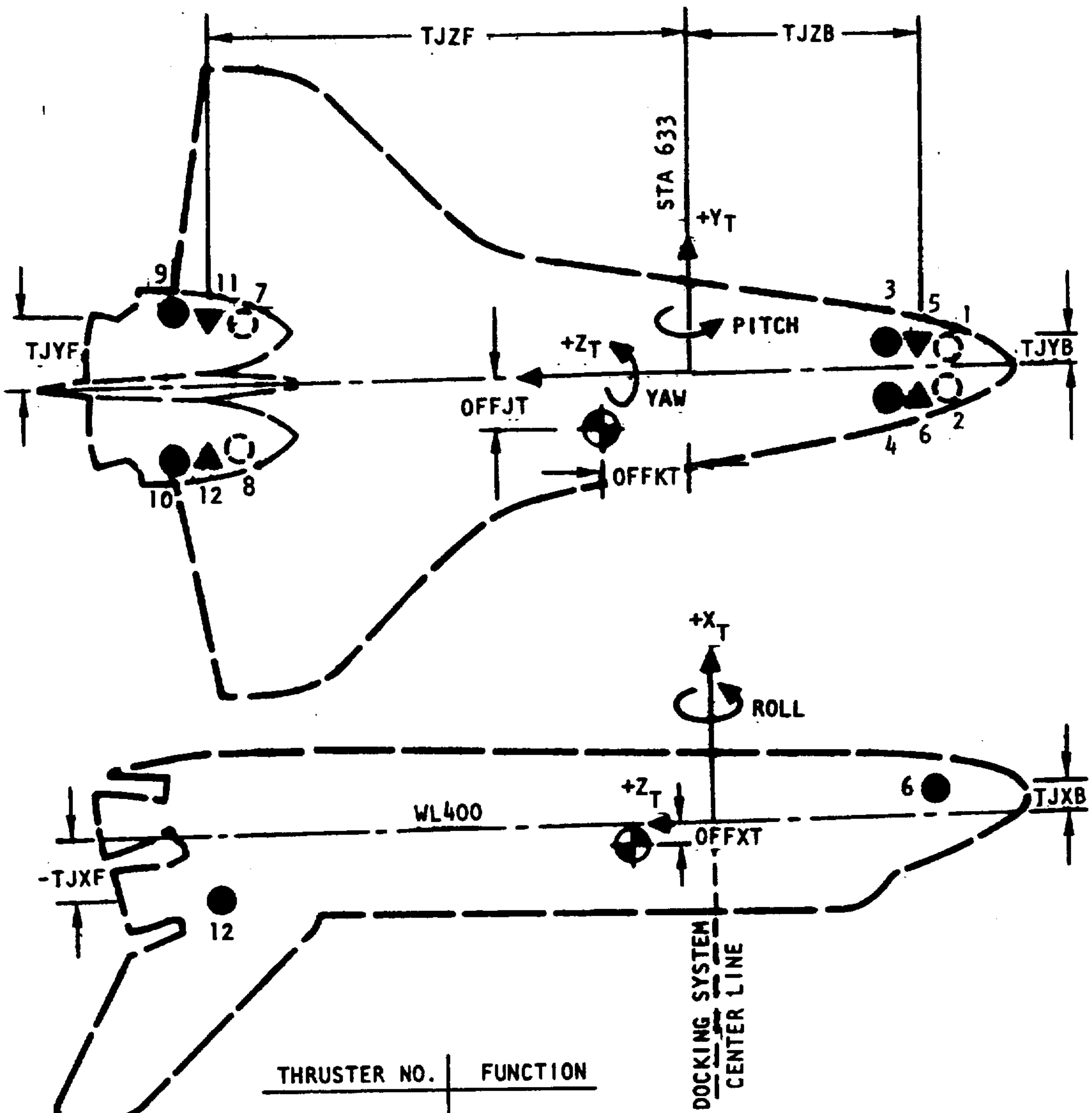


Figure 8. Reaction Control System Geometry



THRUSTER NO.	FUNCTION
7,8,3,4	+PITCH
9,10,1,2	-PITCH
7,10	+YAW
9,8	-YAW
5,12	+ROLL
6,11	-ROLL
3,4,9,10	+X
1,2,7,8	-X

Figure 9. Orbiter Reaction Control System Geometry, Active Vehicle



THRUSTER NO.	FUNCTION
7,8,3,4	+PITCH
9,10,1,2	-PITCH
7,10	+YAW
9,8	-YAW
5,12	+ROLL
6,11	-ROLL
3,4,9,10	+X
1,2,7,8	-X

Figure 10. Orbiter Reaction Control System Geometry, Target Vehicle

The foregoing equations were expanded into the X, Y, Z axes by John A. Schliesing of NASA for the docking dynamics mathematical model. Interdependent sets of the six basic force and moment equations were developed for each of the three bodies relative to its own center of gravity, but referenced to the coordinate system of the target vehicle. To facilitate relative values between the bodies. The equations are:

$$\Sigma F_x - Ma_x = 0 \qquad \Sigma M_x - I_x\dot{\phi} = 0$$
$$\Sigma F_y - Ma_y = 0 \qquad \Sigma M_y - I_y\dot{\theta} = 0$$
$$\Sigma F_z - Ma_z = 0 \qquad \Sigma M_z - I_z\dot{\psi} = 0$$

The locations of the foregoing equations are identified by subroutine in the last section of this guide.

PROGRAM LIMITATIONS

1. The docking program starts itself by positioning the two vehicle centers of gravity with the proper miss distance and angular misalignments at the interface, but with a relatively large axial distance between the docking interfaces. It then iterates by incrementally reducing the axial separation until contact occurs between the docking system guides or guide rings. Once the contact point is established, the vehicles are mathematically released to continue dynamics at the input relative velocities and angular rates. If the geometries of the guides and guide rings are not compatible with the input miss distance and angular misalignment, i.e., a guide misses the oncoming guide ring, the program will continue operating until some computation sees a metal-to-metal penetration that results in a step load of millions of pounds or until a sine/cosine function tries to take the square root of a negative number. An abnormal termination of the run will result.

2. Some of the input values cannot be zero without causing the program to terminate on divide check errors. It is suggested that a small positive number be used instead of zero; otherwise, a search through the listing is in order to determine the effect of the zero prior to a run.

3. There are no small angle approximations in the mathematical descriptions.

4. The program is written on a "flat" earth basis; i.e., orbital mechanics have not been included.

5. There are three time stops in the program that limit run time. The first stop permits a specified run time during which capture must be accomplished; otherwise the program will terminate. The second time stop specifies the duration of post-capture dynamics. The

third time stop is determined by the CPU time specified in the JCL cards. It is recommended that all three input time stops be utilized to prevent waste of auto comp time, print, and plotted data.

6. Since the integration package uses the same integration interval for all three body masses, the smallest mass will determine the size of integration interval that can be used. The larger the interval, the less the auto comp time required, until the interval becomes large enough to cause numerical instability in the dynamics of the smallest mass of the three bodies. At present, some investigation is required to optimize the integration interval to use with a particular set of docking masses.

7. The print interval can be specified in the input data. Care should be exercised in selecting the print interval to prevent the generation of a massive amount of paper.

INPUT DATA

The input data for the "ASTP Docking Dynamics" program are best displayed on the keypunch decimal data forms presented in this section. The data are arranged in lettered arrays in an attempt at maintaining a rationale order. As the program is modified, the order is sometimes violated. The following is the present order of input data as seen in the data forms:

Data Type	Array	Page
Vehicle mass properties	A & B	1
Attenuator locations, guide ring spring constant, hydraulics	C	2 & 3
Initial contact conditions	C & T	3 & 11
Retract mechanism	D	4 & 5
Plot and print controls	E	5
Integration controls	F	6
Active vehicle (CSM) control system	AA	6 & 7
Target vehicle (Soyuz) control system	AT	8 & 9
Orbiter control system	GBABY	7 & 8
Attenuator orifice areas	Cθ	10
Attenuator stroke at orifice areas	SS	10
Guide ring mass properties	ADD	11
Guide locations, latch spring constant	ADD	11 & 12
Attenuator tension spring	ADD	12 & 13
Attentuator return spring and stroke	ORD, ABB	13

Data Type	Array	Page
Attenuator tension or return orifice vs. stroke	Cθ2,SS2	15
Retract motor torque vs. RPM	TQE, RPM	15 & 16
Run title		
Run configuration indicators	Intergers	17

DEFINITION OF INPUT DATA NOMENCLATURE

Input data nomenclature is listed and defined in the description column of the example decimal data forms. Additional explanation is required of some of the more complex input data as follows:

1. C(2) through C(8) locate attenuator connections to the base structure and the guide ring as shown in Figure 11. Angles are positive in the directions shown. The geometry of the guides on the target vehicle duplicate those on the active vehicle. The corresponding target guide edges are numbered as shown in Figure 12.

2. Figure 13 defines attenuator orifice areas and piston areas and presents a diagram of the attenuator.

3. Docking contact conditions (i.e., relative velocity and position combinations existing at initial docking contact) selected for maximum load analysis should satisfy the following general requirements:

   a. Magnitudes should be within the design docking contact conditions listed in the specifications.

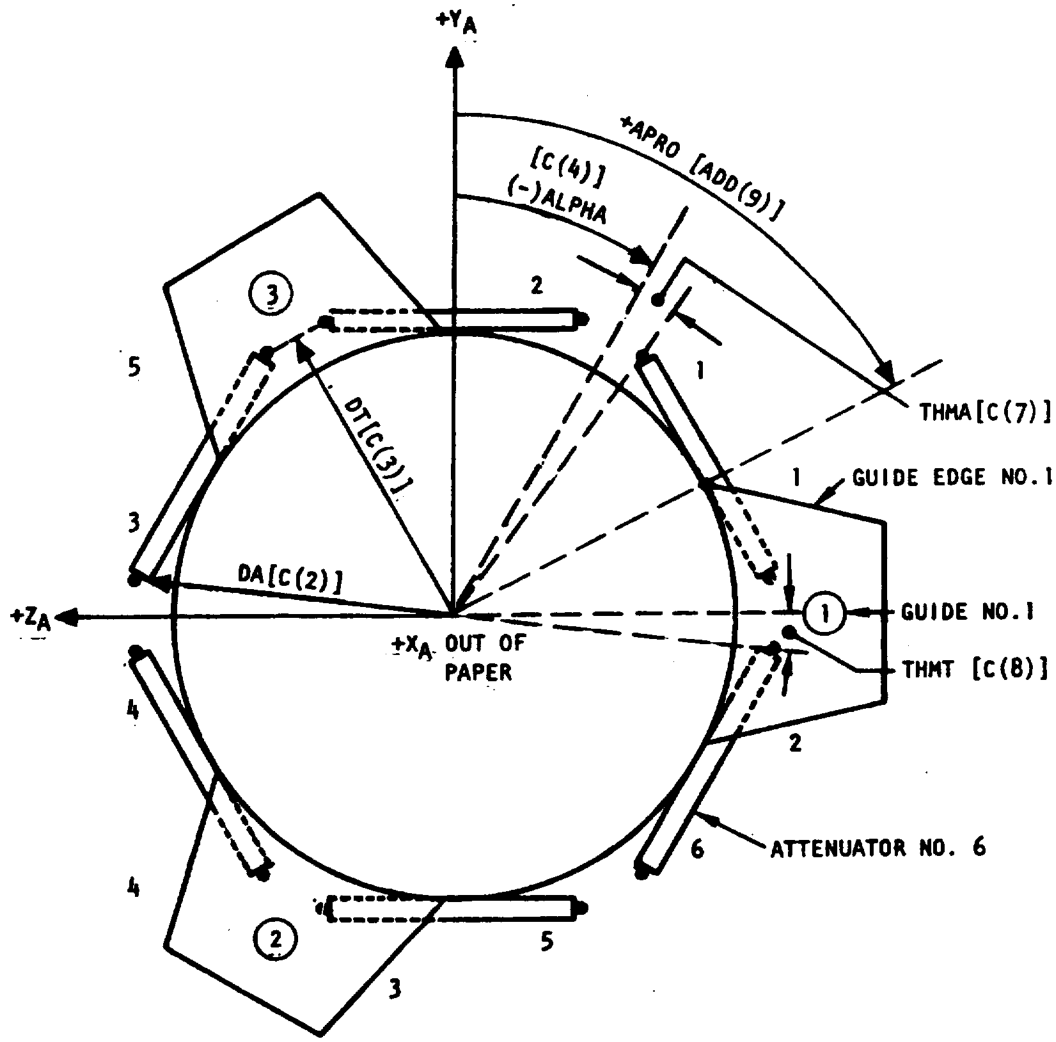
   b. Combinations should be in a direction to maximize the energy of contact.

   c. Conditions should exercise as many possible loading points and mechanism functions as practical.

   The initial contact conditions are defined as follows:

   The relative <u>closing velocity</u> is defined as +X velocity between the vehicle C.G.'s in the passive vehicle axis system.

   The relative <u>lateral velocity</u> is defined as a combination of Y and Z velocities between the vehicle C.G.'s in the passive vehicle axis system.



ALPHA, C(4) - LOCATES THE ATTENUATOR ATTACH POINTS ON THE BASE STRUCTURE OF THE ACTIVE VEHICLE FOR ATTENUATORS NO. 1 AND 2 IN DEGREES. ATTENUATORS ARE NUMBERED COUNTERCLOCKWISE LOOKING IN THE -X DIRECTION.

APRO, ADD(9) - LOCATES GUIDE EDGE NO. 1 INTERSECT WITH THE GUIDE RING IN RADIANS. GUIDE EDGES ARE NUMBERED CLOCKWISE LOOKING IN THE -X DIRECTION.

Figure 11. Active Docking System Guide Edge and Attenuator Locations

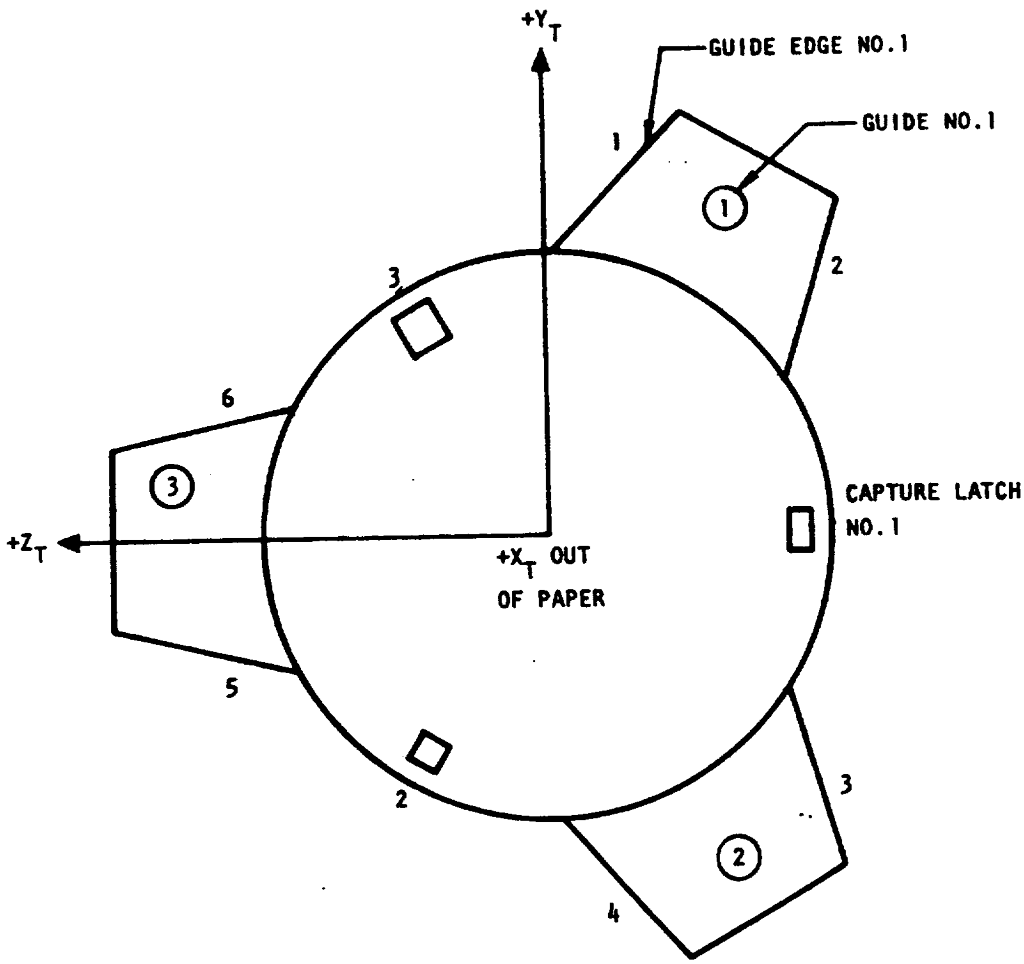
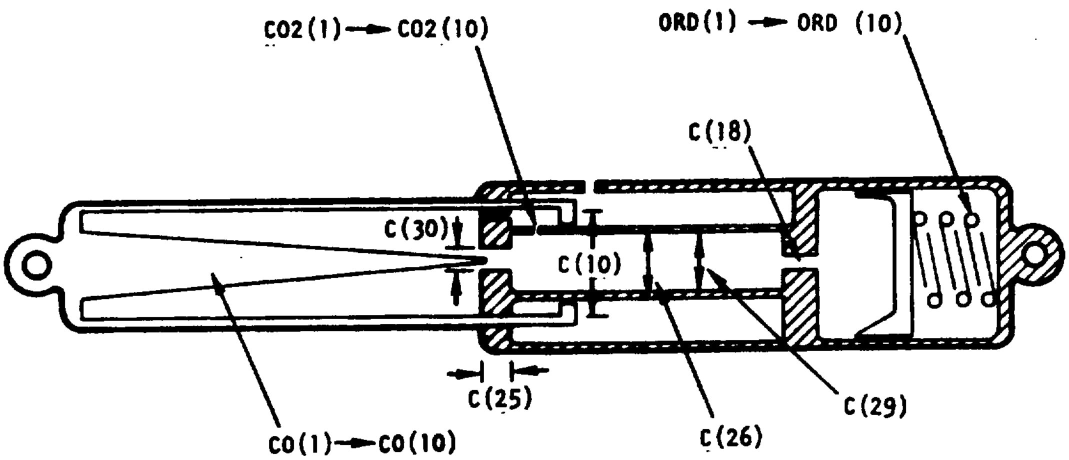


Figure 12. Target Docking System Guide Edge Location



C(10) ATTENUATOR RETURN CYLINDER AREA, AC FOR RETURN
C(11) PUT IN A LARGE NUMBER, EQUATIONS NOT VALID FOR RETURN
C(18) ACCUMULATOR ORIFICE AREA, SAPO
C(25) METERING PIN ORIFICE LENGTH, DLGTH
C(26) RETURN INNER CYLINDER AREA, B FOR RETURN
C(29) ATTENUATOR COMPRESSION CYLINDER AREA, AC FOR COMPRESSION
C(30) OPEN METERING PIN ORIFICE AREA, B FOR COMPRESSION
CO(1) → CO(10) RESULTING ORIFICE AREA AS PIN MOVES
SS(1) → SS(10) STROKE AT POINTS OF PIN ORIFICE AREA
CO2(1) → CO2(10) RETURN ORIFICE AREA ARRAY
SS2(1) → SS2(10) STROKE AT POINTS OF RETURN ORIFICE AREA
ORD(1) → ORD(10) SPRING FORCE ARRAY
ABB(1) → ABB(10) SPRING STROKE PER LOAD ARRAY

Figure 13. Attenuator Characteristics

The miss distance between vehicle docking systems is measured normal (Y and Z directions) to the passive vehicle X axis to a point defined by the centerline of a plane passing through the forwardmost part of the active docking system.

The relative angular velocity between the docking vehicles axes of rotation assumes the passive vehicle has no angular rate and the active vehicle is rotating about any of its axes. The direction of angular velocity will be chosen to amplify the lateral velocity at the docking interface to provide maximum loads and more difficult capture conditions.

The relative attitude between the docking vehicles axes of rotation assumes the passive vehicle is at zero inertial attitude and the active vehicle is misaligned for maximum loads and capture performance. The direction of the angular misalignment will be selected to align the active vehicle X axis as near as possible to the total C.G. relative velocity vector.

The following input data locations define the initial conditions at docking contact:

C(19) - THDRO - Angle about $+X_T$ (right-hand rule) measured from $+Y_T$ to the radial in which miss distance is to exist.

C(20) - XMISS - Lateral distance between docking system centerlines, miss distance, unfortunately named XMISS.

C(40) - THANG - Angle about $+X_T$ (right-hand rule) measured from $+Y_T$ to the plane of pitch/yaw misalignment.

C(41) - THTOT - Relative angular misalignment in the pitch/yaw misalignment plane.

C(42) - THVEL - Angle about $+X_T$ (right-hand rule) measured from $+Y_T$ to the radial in which lateral velocity is to exist.

C(43) - VL - Radial velocity, relative laterial velocity.

C(44) - OMEGR - Relative roll rate.

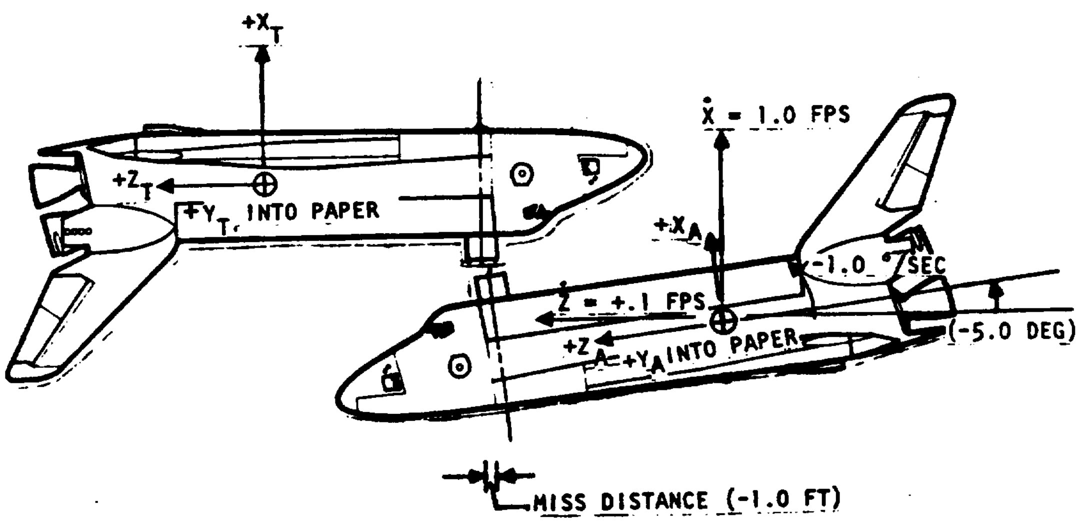
C(45) - OMEGT - Relative angular rate in the pitch/yaw plane.

C(46) - THOMEL - Angle about $+X_T$ (right-hand rule) measured from $+Y_T$ to the pitch/yaw plane in which angular rate is to exist.

T(25) - XAD - Closing velocity in the $+X_A$ direction.

The above input for initial conditions is demonstrated by the example shown in Figure 14.

	DESIRED CONDITION		REQUIRED INPUT
$\dot{X}$	CLOSING VELOCITY	= 1.0 FPS	T(25) = 1.0
$\dot{Y}$	LATERAL VELOCITY	= 0 FPS	C(42) = 90. C(43) = +0.1
$\dot{Z}$	LATERAL VELOCITY	= +.1 DEG/SEC	
$\dot{\theta}_r$	PITCH RATE	= -1.0 DEG/SEC	C(46) = 90. C(45) = -1.
$\dot{\psi}_z$	ROLL RATE	= 0 DEG/SEC	
$\dot{\phi}_x$	YAW RATE	= 0 DEG/SEC	C(44) = 0.0
θ_r	PITCH ANGLE	= -5 DEG	C(40) = 90. C(41) = -5.
ψ_z	ROLL ANGLE	= 0 DEG	
ϕ_x	YAW ANGLE	= 0 DEG	T(14) = 0.0
Y	MISS DISTANCE	= 0 FT	C(19) = 90. C(20) = -1.0
Z	MISS DISTANCE	= -1.0 FT	



THE DOCKING SYSTEM CENTER LINE MUST BE INPUT PARALLEL TO THE MATH MODEL X AXIS; I.E., MASS PROPERTIES NORMALLY PUBLISHED WITH X AXIS POINTING OUT THE FRONT OF THE VEHICLE MUST BE ROTATED TO PARALLEL THE DOCKING SYSTEM.

Figure 14. Diagram of Initial Conditions

4. The maximum load search interval E(4) and case number I(5) provide punched card data at time slices where maximum loads occur on the target vehicle docking system. The cards are used in an ancillary program, written by Herb Reed in Department 215, to print out maximum loads data in the format used in ASTP documentation. The ancillary program has not yet been incorporated in the "ASTP Docking Dynamics" program.

5. The CRT plotting subroutine stores 1100 data points per parameter. If E(8)-DESLC is input too small, plotted data points will end before the run stops. If E(8) is input as >100 seconds, the program will automatically set the plot interval to spread the data points throughout the run time input in E(3) summed with ADD(74).

6. Both the active vehicle and target vehicle control systems can change control modes based on time prior to capture latch and time after latch engagement. AA(1) specifies a time after contact that closing thrust will be applied to the active vehicle. AA(18) specifies how long after capture latch closing thrust will terminate. AA(17) set equal to -1.0 will cause the active vehicle attitude rate gains to switch to the values in AA(19), AA(20), and AA(21), which, if set equal to zero, will simulate the "free" or "drift" mode. All other control system parameters are defined in the control system discussion.

7. The guide ring mass properties, guide location, and guide geometry are described by input data ADD(1) through ADD(18). All are self-explanatory except ADD(14) through ADD(17), which are clarified in Figure 15.

8. The capture latch is a roller that locks in bearing on a 45-degree surface of the target vehicle interface at the center of each guide. The spring constant of the latch and backup structure, as well as the resulting latch load, is oriented internal to the program at a 45-degree angle. The load direction on the roller is radially outboard at the center of each active guide 45 degrees off the +X axis as shown in Figure 5.

SHUTTLE ORBITER DOCKING INPUT DATA

The following pages are a list of the loads analysis, computer input data. The input data describe the docking system characteristics, docking vehicle mass properties, and vehicle control system characteristics as used for orbiter docking to orbiter.

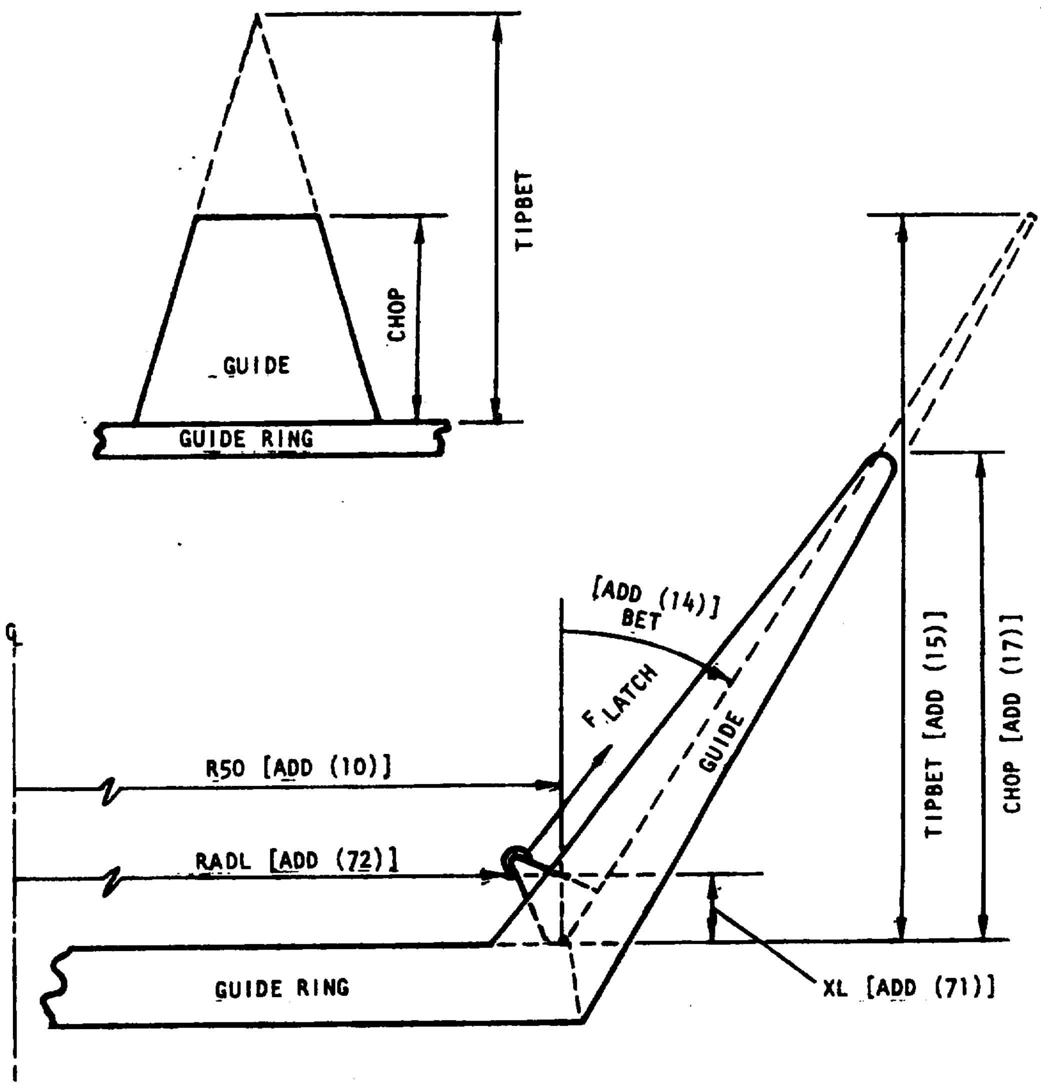


Figure 15. Guide Geometry

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

ORBITER DOCKING SYSTEM MATH MODEL

DECK NO.______ PROGRAMMER G.O. MOUNT DATE 5/2/74 PAGE 1 of 17 JOB NO.______

	NUMBER		D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	&INPUT	-			NAME LIST	
13	A=+0.0	-	,	ACTIVE VEHICLE	A(1) NOT USED	
25	+7370.0	-	,	MASS PROPERTIES	A(2) MASS, ACTIVE VEHICLE	SLUGS
37	+6865000.	-	,		A(3) Ixx INERTIA, " "	SLUG-FT²
49	+6738000.	-	,		A(4) Iyy " " "	"
61	+856000.	-	,		A(5) Izz " " "	"
1	+0.001	-	,		A(6) Ixy " " "	"
13	-0.252	-	,		A(7) Ixz " " "	"
25	+0.002	-	,		A(8) Iyz " " "	"
37	+0.083	-	,		A(9) Y-DIST, C.G. TO ℄ " "	FT
49	+37.8	-	,		A(10) Z-DIST, " " "	"
61	+9.47	-	,		A(11) X-DIST, " " "	"
1	B=+0.0	-	,		B(1) NOT USED	
13	+7370.	-	,	TARGET VEHICLE	B(2) MASS, TARGET VEHICLE	SLUGS
25	+6865000.	-	,	MASS PROPERTIES	B(3) Ixx INERTIA " "	SLUG-FT²
37	+6738000.	-	,		B(4) Iyy " " "	"
49	+856000.	-	,		B(5) Izz " " "	"
61	+0.001	-	,		B(6) Ixy " " "	"
1	-0.252	-	,		B(7) Ixz " " "	"
13	+0.002	-	,		B(8) Iyz " " "	"
25	-0.083	-	,		B(9) Y-DIST, C.G. TO ℄ " "	FT
37	-37.8	-	,		B(10) Z-DIST, " " "	"
49	-9.47	-	,		B(11) X-DIST, " " "	"
61		-				

FORM 114-C-16 (BOND)

FORTRAN FLOATING 5 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 2 of 17 JOB NO. ______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	C = +0.0		ATTENUATOR & RING GEOM.	C(1) NOT USED	
13	+2.34			C(2) DA, RADIUS TO ATTENUATOR @ BASE	FT
25	+2.74			C(3) DT, RADIUS TO ATTENUATOR @ RING	"
37	-30.0			C(4) ALPHA, ANGLE TO PT. BTW. ATTN #1 & 2	DEGREES
49	+1.0			C(5) EXT, = +1.0 EXTERNAL GUIDES, = -1.0 INTERNAL	N/D
61	+0.0			C(6) NOT USED	
1	+30.0			C(7) THMA, HALF ANGLE BTW ATTEN @ BASE	DEGREES
13	+6.5			C(8) THMT, " " " " @ RING	"
25	+97800.			C(9) SKS, RING AXIAL SPRING CONSTANT	LBS/FT
37	+1.767			C(10) AC, RETURN CYLINDER AREA	IN^2
49	+10[illegible].			C(11) MUST BE A LARGE NO. [illegible]	IN^2
61	+0.0			C(12) NOT USED	
1	+0.0			C(13) " "	
13	+0.0			C(14) " "	
25	+0.0			C(15) " "	
37	+12.5			C(16) FRICP, ATTENUATOR RUNNING FRICTION	LBS
49	+0.0			C(17) NOT USED	
61	+0.391			C(18) SAPO, ACCUM. PISTON ORFICE AREA	IN^2
1	+0.0		INITIAL CONDITION	C(19) THDRO, ANGLE WRT Y-AXIS TO RADIAL MISS	DEGREES
13	+0.0		" "	C(20) XMISS, MISS DISTANCE OUT RADIAL	FT
25	+0.0			C(21) NOT USED	
37	+1.0			C(22) NOT USED	"
49	+0.0			C(23) RSX, X-DIST TO STRUCTURAL CHECK PLANE	"
61	+2.135			C(24) RSR, RADIUS TO STRUCTURE AT CHECK PLANE	"

FORM 114-C (SOND)

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.______ PROGRAMMER______________ DATE________ PAGE 3 of 17 JOB NO.________

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	+0.12		ATTENUATOR HYDRAULICS	C(25) DLGTH, ORIFICE LENGHT	IN
13	+1.22797			C(26) B, RETURN INNER CYLINDER AREA	IN^2
25	+6.2			C(27) XKV, KINEMATIC VISCOSITY	IN^2/SEC
37	+0.0000944			C(28) RHO, HYDRAULIC FLUID MASS DENSITY	LB^2SEC/IN^4
49	+1.22718			C(29) AC, ATTENUATOR CYLINDER AREA	IN^2
61	+0.19635			C(30) B, METERING PIN AREA	IN^2
1	+9*0.0			C(31) → C(39) USED INTERNALLY	
13					
25					
37	+0.0		INITIAL CONDITION	C(40) THANG,	DEGREES
49	+0.0			C(41) THTOT,	"
61	+0.0			C(42) THVEL,	"
1	+0.0			C(43) VL,	FT/SEC
13	+0.0			C(44) OMEGR,	DEG/SEC
25	+0.0			C(45) OMEGT,	"
37	+0.0			C(46) THOMEL,	DEGREES
49	+0.0			C(47) USED INTERNALLY	
61	+0.0			C(48) " "	
1	+0.0			C(49) " "	
13	+0.0			C(50) " "	
25					
37					
49					
61					

FORM 114-C-16 (BOND)

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 4 of 17 JOB NO. ______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	D=+0.0	,		D(1) USED INTERNALLY	
13	+0.0	,		D(2) " "	
25	+0.0	,		D(3) " "	
37	+0.0	,		D(4) NOT USED	
49	+1.0	,		D(5) >0.0 REINITIALIZES STANDARD DATA	N/D
61	+7.5	,		D(6) SPAN(1), CABLE LENGTH, MOTOR TO ATTACH.	FT
1	+7.5	,	RETRACT SYSTEM DATA	D(7) SPAN(2), " "	"
13	+7.5	,		D(8) SPAN(3), " "	"
25	+0.0	,		D(9) SPAN(4), " "	"
37	+0.0	,		D(10) SPAN(5), " "	"
49	+0.0	,		D(11) SPAN(6), " "	"
61	+0.0	,		D(12) USED INTERNALLY	
1	+0.0	,		D(13) " "	
13	+0.0	,		D(14) " "	
25	+0.0	,		D(15) OMEGM, MOTOR RATE, =0.0 UNLESS REINITIALIZED	RAD/SEC
37	+0.198	,		D(16) RPULL, CABLE DRUM RADIUS	FT
49	-0.1117	,		D(17) XB, DIST. FRM. ATTN. BASE TO ATTACH PT.	"
61	+234000.	,		D(18) SKCAB, CABLE SPRING CONSTANT	LBS/FT/FT
1	+30.0	,		D(19) WAIT, RETRACT START TIME	SECONDS
13	+0.0	,		D(20) XCR, DIST. FRM. ATTN. END TO CABLE ATTACH	FT
25	+2.54	,		D(21) CRADB, RADIUS TO BASE CABLE PULLEYS	"
37	+2.54	,		D(22) CRADR, RADIUS TO RING CABLE ATTACH	"
49	+0.0	,		D(23) USED INTERNALLY	
61	+0.60	,		D(24) EFF, RETRACT GEAR EFFICENCY	N/D

FORM 114-C-1 (BIND)

Space Division
Rockwell International

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.____ PROGRAMMER____ DATE____ PAGE 5 of 17 JOB NO.____

	NUMBER		D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	+6560.	-	,		D(25) GEAR, GEAR RATIO, ROUT/R MOTOR	N/D
13	+0.00027	5	,		D(26) D MOTOR, MOTOR MOMENT OF INERTIA	SLUG-FT²
25	+0.0	-	,		D(27) NOT USED	
37	+0.0	-	,		D(28) NOT USED	
49	+0.0	-	,	73 80	D(29) USED INTERNALLY	
61	+0.0	-	,		D(30) " "	
1	E=+0.0	-	,		E(1) " "	
13	+0.0	-	,		E(2) " "	
25	+8.0	-	,	OUTPUT CONTROL	E(3) STOP, STOP TIME PRIOR TO CAPTURE	SECONDS
37	+0.002	-	,		E(4) , MAX LOAD SEARCH INTERVAL SDELP	"
49	+4.0	-	,	73 80	E(5) CASE, CASE NUMBER IF LOADS SEARCHED	N/D
61	+0.0	-	,		E(6) USED INTERNALLY	
1	+.1	-	,		E(7) DELP, OUTPUT PRINT INTERVAL	SECONDS
13	+0.00909	-	,		E(8) DESLC, MINIMUM PLOT INTERVAL	"
25	+0.0	-	,		E(9) USED INTERNALLY	
37	+0.0	-	,		E(10) " "	
49		-		73 80		
61		-				
1		-				
13		-				
25		-				
37		-				
49		-		73 80		
61		-				

FORM 111-C-1L (BOND)

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.______ PROGRAMMER______ DATE______ PAGE 6 of 17 JOB NO.______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	F = +0.0005	-	INTEGRATION CONTROL	F(1) A2A, MAX. INTEGRATION ERROR, POST CAPTURE	N/D
13	+0.0003	-		F(2) TMESH, INITIAL INTEGRATION STEP SIZE	SECONDS
25	+0.0	-		F(3) USED INTERNALLY	
37	+0.0	-		F(4) A3, MIN. INTEGRATION ERROR	N/D
49	+0.01	-		F(5) A5, MAX. INTEGRATION STEP SIZE	SECONDS
61	+0.0	-		F(6) KA1, = 0.0 VARIABLE STEP, = +1.0 A.M. STEP, = -1.0 R.K. STEP	N/D
1	+0.00001	-		F(7) A2, MAXIMUM INTEGRATION ERROR	N/D
13	+0.0003	-		F(8) A9, MIN. STEP SIZE BEFORE CAPTURE	SECONDS
25	+0.2	-		F(9) A7, REDUCTION MULTIPLIER FOR STEP SIZE	N/D
37	+0.001	-		F(10) A4A, MIN. STEP SIZE AFTER CAPTURE	SECONDS
49		-			
61		-			
1	AA = 1000.	-	ACTIVE VEHICLE CONTROL SYST.	AA(1) REACTI, TIME FROM I.C. TO X-THRUST	SECONDS
13	+0.0	-		AA(2) THCOMA, COMMANDED ATTITUDE, PITCH	DEGREES
25	+0.0	-		AA(3) PHCOMA, " " , ROLL	"
37	+0.0	-		AA(4) PSCOMA, " " , YAW	"
49	+0.7	-		AA(5) ARXA, RATE GAIN, ROLL	DEG/DEG/SEC
61	+0.7	-		AA(6) ARYA, " " , PITCH	"
1	+0.7	-		AA(7) ARZA, " " , YAW	"
13	+1.0	-		AA(8) ADPHA, ATTITUDE GAIN, ROLL	DEG/DEG
25	+1.0	-		AA(9) ADTHA, " " , PITCH	"
37	+1.0	-		AA(10) ADPSA, " " , YAW	"
49	+0.0	-		AA(11) RADA, RADIUS TO JETS, APOLLO CSM ONLY	FT
61	+900.	-		AA(12) FIREA, THRUST PER JET	LBS

FORM 114-C-16 (BOND)

ORIGINAL PAGE IS
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FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 7 of 17 JOB NO. ______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	+0.023		ACTIVE VEHICLE CONTROL SYSTEM	AA(13) BURNA, MINIMUM JET BURN TIME	SECONDS
13	+0.43			AA(14) DBANXA, ATTITUDE DEAD BAND, ROLL	DEGREES
25	+0.43			AA(15) DBANYA, " " ", PITCH	"
37	+0.43			AA(16) DBANZA, " " ", YAW	"
49	+1.0			AA(17) FXA, IF > 0 HOLDS ATTITUDE AFTER CAPTURE	N/D
61	+0.5			AA(18) REACTA, X-THRUST CUT-OFF AFTER CAPTURE	SECONDS
1	+0.7			AA(19) BANXA, RATE GAIN AFTER CAPTURE, ROLL	DEG/DEG/SEC
13	+0.7			AA(20) BANYA, " " " ", PITCH	"
25	+0.7			AA(21) BANZA, " " " ", YAW	"
37	+0.0			AA(22) USED INTERNALLY	
49	+10.0			AA(23) RMAXA, ATTITUDE ERROR LIMIT, ROLL	DEGREES
61	+10.0			AA(24) PMAXA, " " ", YAW	"
1	+10.0			AA(25) YMAXA, " " ", PITCH	"
13					
25					
37					
49					
61					
1	GBABY=1.22		ORBITER RCS MOMENT ARMS	GBABY(1) OFFXA, X-DIST, C.G. TO ℄ ACTIVE VEHICLE	FT
13	-1.22			GBABY(2) OFFXT, " " " TARGET "	"
25	-3.9			GBABY(3) AJXF, ACTIVE, JET X-MOMENT ARM, FRONT	"
37	+6.4			GBABY(4) AJXB, " " X " ", BACK	"
49	+26.4			GBABY(5) AJZF, " " Z " ", FRONT	"
61	-75.			GBABY(6) AJZB, " " Z " ", BACK	"

FORM 116-C-16 (BOND)

Space Division
Rockwell International

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 8 of 17 JOB NO. ______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	+8.1		ORBITER RCS MOMENT ARMS	GBABY(7) AJYF, ACTIVE, JET Y-MOMENT, FRONT	FT
13	+10.0			GBABY(8) AJYB, " " Y " , BACK	"
25	-6.4			GBABY(9) TJXF, TARGET, " X " , FRONT	"
37	+3.9			GBABY(10) TJXB, " " X " , BACK	"
49	+75.0			GBABY(11) TJZF, " " Z " , FRONT	"
61	-26.4			GBABY(12) TJZB, " " Z " , BACK	"
1	+10.0			GBABY(13) TJYF, " " Y " , FRONT	"
13	+8.1			GBABY(14) TJYB, " " Y " , BACK	"
25					
37					
49					
61					
1	AT=+100.		TARGET VEHICLE CONTROL SYSTEM	AT(1) REACTI, TIME FROM I.C. TO X-THRUST	SECONDS
13	+0.0			AT(2) RADTY, Y-DIST. TO RCS JETS FROM ℄(some)	FT
25	+0.0			AT(3) RADTZ, Z-DIST. TO RCS JETS FROM ℄(some)	"
37	+900.			AT(4) FIRET, RCS JET THRUST	LBS
49	+0.23			AT(5) BURNT, MINIMUM BURN TIME	SECONDS
61	+0.7			AT(6) ARXT, RATE GAIN, ROLL	DEG/DEG/SEC
1	+0.7			AT(7) ARYT, " " , PITCH	"
13	+0.7			AT(8) ARZT, " " , YAW	"
25	+1.0			AT(9) ADPHT, ATTITUDE GAIN, ROLL	DEG/DEG
37	+1.0			AT(10) ADTHT, " " , PITCH	"
49	+1.0			AT(11) ADPST, " " , YAW	"
61	+0.43			AT(12) DBANXT, ATTITUDE DEAD BAND, ROLL	DEGREES

FORM 114-C-15 (BOND)

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.____ PROGRAMMER ____ DATE ____ PAGE 9 of 17 JOB NO. ____

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	+0.43	-	TARGET VEHICLE CONTROL SYSTEM	AT(13) DBANYT, ATTITUDE DEAD BAND, PITCH	DEGREES
13	+0.43	-		AT(14) DBANZT, " " " , YAW	"
25	+0.0	-		AT(15) THCOMT, ATTITUDE COMMAND, PITCH	"
37	+0.0	-		AT(16) PHCOMT, " " , ROLL	"
49	+0.0	-		AT(17) PSCOMT, " " , YAW	"
61	+0.5	-		AT(18) REACTT, TIME X-THRUST CUTOFF AFTER CAPTURE	SECONDS
1	+0.0	-		AT(19) BANXT, RATE GAIN AFTER CAPTURE ROLL	DEG/DEG/SEC
13	+0.0	-		AT(20) BANYT, " " " " , PITCH	"
25	+0.0	-		AT(21) BANZT, " " " " , YAW	"
37	+0.0	-		AT(22) DO1, C.G. TO X-JETS, SOYUZ	FT
49	+0.0	-		AT(23) DO2, " " Z " "	"
61	+0.0	-		AT(24) DO3, " " Y " "	"
1	-1.0	-		AT(25) TMT, IF >0 HOLDS ATTITUDE AFTER CAPTURE	N/A
13	+10.0	-		AT(26) RMAXT, ATTITUDE ERROR LIMIT, ROLL	DEGREES
25	+10.0	-		AT(27) YMAXT, " " " , PITCH	"
37	+10.0	-		AT(28) PMAXT, " " " , YAW	"
49	+0.0	-		AT(29) USED INTERNALLY	
61	+0.0	-		AT(30) " "	
1		-			
13		-			
25		-			
37		-			
49		-			
61		-			

FORM 114-C-16 (BOND)

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.______ PROGRAMMER ______ DATE ______ PAGE 10 of 17 JOB NO. ______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	CØ=+0.18	-	ATTENUATOR METERING PIN ORIFICE AREA	CØ(1) ATTENUATOR COMPRESSION ORIFICE AREA	IN.^{2}
13	+0.18	-		CØ(2) " " "	"
25	+0.0095	-		CØ(3) " " "	"
37	+0.005	-		CØ(4) " " "	"
49	+0.00235	-		CØ(5) " " "	"
61	+0.00158	-		CØ(6) " " "	"
1	+0.0012	-		CØ(7) " " "	"
13	+0.0012	-		CØ(8) " " "	"
25		-		CØ(9)	
37		-		CØ(10)	
49		-			
61		-			
1	SS=-1.0	-	ATTENUATOR METERING PIN STROKE	SS(1) ATTENUATOR STROKE @ COMP. ORIFICE AREA	IN
13	+0.0	-		SS(2) " " "	"
25	+2.7	-		SS(3) " " "	"
37	+3.5	-		SS(4) " " "	"
49	+4.0	-		SS(5) " " "	"
61	+4.3	-		SS(6) " " "	"
1	+4.5	-		SS(7) " " "	"
13	+12.0	-		SS(8) " " "	"
25		-		SS(9)	
37		-		SS(10)	
49		-			
61		-			

FORM 114-C-1 (10-70)

ORIGINAL PAGE IS OF POOR QUALITY

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.______ PROGRAMMER______ DATE______ PAGE 11 of 17 JOB NO.______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	T=18*0.0	-	INITIAL CONDITION →	T(1) THROUGH T(18) USED INTERNALLY	
13	+1.58	-		T(19) XP, X-DIST FRM BASE TO RING ATTACH	FT
25	+0.0	-		T(20) YP, Y " " " " "	"
37	+0.0	-		T(21) ZP, Z " " " " "	"
49	+0.0	-		T(22) USED INTERNALLY	
61	+2*0.0	-		T(23), T(24) " "	
1	+1.0	-	INITIAL CONDITION →	T(25) XAD, ACTIVE VEHICLE CLOSING VEL	FT/SEC
13	+17*0.0	-		T(26) THROUGH T(42) USED INTERNALLY	
25	+0.0	-		T(43) TIME Z.C. MUST BE ZERO	N/D
37		-			
49		-			
61		-			
1	ADD=.0018		RING & GUIDE DATA	ADD(1) RR, X-DIST. FRM RING C.G. TO ATTN. ATTACH PLANE	FT
13	+0.0	-		ADD(2) OFFJR, Y-DIST. FROM C.G. TO ℄ OF RING	"
25	+0.0	-		ADD(3) OFFKR, Z " " " " "	"
37	+8.07	-		ADD(4) XMR, GUIDE RING MASS	SLUG
49	+21.5	-		ADD(5) XXIR, MOMENT OF INERTIA, ROLL	SLUG-FT^2
61	+12.2	-		ADD(6) YYIR, " " " , PITCH	"
1	+12.2	-		ADD(7) ZZIR, " " " , YAW	"
13	+0.0	-		ADD(8) USED INTERNALLY	
25	+1.0471975			ADD(9) APRO, ANGLE FRM +Y TO GUIDE EDGE #1	RADIANS
37	+2.132	-		ADD(10) R5O, RADIUS TO RING/GUIDE EDGE INTERSECT	FT
49	+0.0144	-		ADD(11) AX5, X-DIST. FRM RING C.G. TO GUIDE INTERSECT	"
61	+0.0	-		ADD(12) AY5, Y-DIST. FRM RING C.G. TO GUIDE PLANE ℄	"

FORM 114-C-16 (BOND)

Space Division
Rockwell International

FORMAT ... DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 12 of 17 JOB NO. ______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	+0.0		RING GUIDE & LATCH DATA	ADD(13) AZS, Z-DIST. FRM RING CL. TO GUIDE PLANE &	FT
13	+0.90757			ADD(14) BET, ANGLE FRM X-AXIS TO GUIDE FACE	RADIANS
25	+4.12			ADD(15) TIPBET, AXIAL DIST. FROM RING TO GUIDE APEX	FT
37	+0.0			ADD(16) TPRO, COMPUTED INTERNALLY	
49	+1.16			ADD(17) CHOP, AXIAL DIST., CUT LENGTH OF GUIDE	FT
61	+21800.			ADD(18) SK, EQUIV. SPRING CONST. OF GUIDE & RING	LB/FT
1	+10*0.0			ADD(19) THROUGH ADD(28) USED INTERNALLY	
13	+106200.			ADD(29) SKL, EQUIV. SPRING CONST. OF GUIDE & LATCH	LB/FT
25	+27*0.0.			ADD(30) THROUGH ADD(56) USED INTERNALLY	
37	+1.58			ADD(57) XPO, SAME AS XP	FT
49	+13*0.0			ADD(58) THROUGH ADD(70) NOT USED	
61	+0.325			ADD(71) XL, AXIAL DIST. FRM GUIDE INTERSECT TO LATCH	FT
1	+2.34			ADD(72) RADL, RADIUS TO LATCHES	FT
13	+0.0			ADD(73) NOT USED	
25	+50.0			ADD(74) STOPL, STOP TIME AFTER TOTAL LATCH	SECONDS
37	+0.007			ADD(75) HYSA, BURN HYSTERISIS, ACTIVE VEH.	"
49	+0.007			ADD(76) HYST, " " , TARGET "	"
61	+4*0.0			ADD(77) THROUGH ADD(80) NOT USED	
1	+0.0		ATTENUATOR SPRING DATA	ADD(81) ATTENUATOR TENSION SNUBBER FORCE TABLE	LBS
13	+50.0			ADD(82) " " "	"
25	+320000.			ADD(83) " " "	"
37	7*0.0			ADD(84) " " "	"
49				ADD(85) TOTAL OF 10 PTS	..
61				ADD(86)	..

FORM 114 ... (BOND)

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.____ PROGRAMMER____ DATE____ PAGE 13 of 17 JOB NO.____

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	+0.0		ATTENUATOR SPRING DATA	ADD (91) ATTENUATOR TENSION SNUBBER STROKE TABLE	FT
13	+0.001			ADD (92) " " "	"
25	+0.999			ADD (93) " " "	"
37	7+0.0			ADD (94) " " "	"
49				ADD (95) TOTAL OF 10 PTS.	
61				ADD (96)	
1	ØRD=+0.0			ØRD (1) ATTENUATOR COMPRESSION SPRING LOAD TABLE	LBS
13	+22.5			ØRD (2) " " "	"
25	+31.5			ØRD (3) " " "	"
37	+302.5			ØRD (4) " " "	"
49	+332.5			ØRD (5) " " "	"
61	+16000.			ØRD (6) " " "	"
1	ABB=+0.0			ABB (1) ATTENUATOR COMPRESSION SPRING STROKE TABLE	FT
13	+0.001032			ABB (2) " " "	"
25	+0.468			ABB (3) " " "	"
37	+0.676			ABB (4) " " "	"
49	+0.7			ABB (5) " " "	"
61	+0.75			ABB (6) " " "	"
1				TOTAL OF 10 PTS EA.	
13					
25					
37					
49					
61					

FORM 114-C-16 (BOND)

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO.______ PROGRAMMER.______ DATE______ PAGE 15 of 17 JOB NO.______

NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
CØ2 = +.0011	1,	ATTENUATOR HYDRAULIC RETURN ORIFICE	CØ2(1) ATTENUATOR, RETURN ORIFICE, AREA	IN²
+0.0011	-,		CØ2(2) " " "	"
+0.0011	-,		CØ2(3) " " "	"
+0.0011	-,		CØ2(4) " " "	"
+0.0011	-,		CØ2(5) " " "	"
+	-		CØ2(6) TOTAL OF 10 PTS	
SSZ = -1.0	-		SSZ(1) ATTENUATOR, RETURN ORIFICE, STROKE	IN
+0.0	-,		SSZ(2) " " "	"
+0.937	-,		SSZ(3) " " "	"
+1.0	-,		SSZ(4) " " "	"
+12.0	-,		SSZ(5) " " "	"
	-,		SSZ(6) TOTAL OF 10 PTS	"
TQE = +0.771	1,	RETRACT MOTOR TORQUE	TQE(1) RETRACT MOTOR TORQUE LIMIT, TORQUE TABLE	FT-LBS
+0.771	-,		TQE(2) " " "	"
+0.762	-,		TQE(3) " " "	"
+0.75	-,		TQE(4) " " "	"
+0.729	-,		TQE(5) " " "	"
+0.703	-,		TQE(6) " " "	"
+0.656	-,		TQE(7) " " "	"
+0.6825	-,		TQE(8) " " "	"
+0.458	-,		TQE(9) " " "	"
+0.239	-,		TQE(10) " " "	"
+0.0	-,		TQE(11) " " "	"
+0.0	-,		TQE(12) " " TOTAL 15 PTS	"

FORM 114-C-16 (BOND)

ORIGINAL PAGE IS
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FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO._____ PROGRAMMER_____ DATE_____ PAGE 16 of 17 JOB NO._____

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH	UNITS
1	RPM=+0.0		73 … 80	RPM(1) RETRACT MOTOR RATE LIMIT, RATE TABLE	RAD/SEC
13	+209.4			RPM(2) " " "	"
25	+418.8			RPM(3) " " "	"
37	+523.5			RPM(4) " " "	"
49	+628.2			RPM(5) " " "	"
61	+732.9			RPM(6) " " "	"
1	+837.6		73 … 80	RPM(7) " " "	"
13	+942.3			RPM(8) " " "	"
25	+1047.0			RPM(9) " " "	"
37	+1151.7			RPM(10) " " "	"
49	+1230.0			RPM(11) " " "	"
61	+1230.0			RPM(12) " " TOTAL OF 15 PTS	"
1			73 … 80		
13					
25					
37					
49					
61					
1			73 … 80		
13					
25					
37					
49					
61					

FORM 114-C-16 (BOND)

Space Division
Rockwell International

FORTRAN FLOATING 8 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 17 of 17 JOB NO. ______

	NUMBER	D	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	TTL1=48H	3		TITLE "CASE 3 ASTP, HYDRAULIC SYSTEM",
13	ASTP, HYD	RA		IS WRITTEN ON CRT AND PRINT. LENGTH
25	ULIC SYSTE	M		IS LIMITED TO 48 SPACES FOLLOWING H.
37				PLACE COMMA AT END
49	,			THE FOLLOWING ARE INTEGER NUMBERS, COMMAS
61				REPLACE DECIMAL POINTS, MUST BE NEXT TO NUMBER.
1	IPHASE=1,			TYPE OF START, =1 CONTACT, =0 NO CONTACT, =3 LATCHED
13	N=52,			NUMBER OF VARIABLES INTEGRATED
25	IRCS=3,			ACTIVATES RCS, =1 ACTIVE VEHICLE, =2 TARGET, =3 BOTH =0 NONE
37	IVEH=1,			TYPE CONTROL SYSTEM FOR TARGET, SOYUZ=1, S4IIB=0
49	ISIMPL=1,			TYPE INITIAL CONDITION INPUT---ALWAYS=1
61	JN=8,			NUMBER OF ATTENUATOR ORIFICE AREA POINTS IN CØ ARRAY
1	MPLOT=7,			PLOTS EVERY "MPLOT" INTEGRATIONS
13	NFING=3,			NUMBER OF GUIDES ON GUIDE RING
25	NATTEN=6,			" " ATTENUATORS
37	IGRAPH=1,			=1 PLOT CRT, =0 NO PLOTS
49	ITABLE=1,			NOT USED
61	IH=-20,			ALWAYS = -20
1	IXTRA=3,			NUMBER OF POINTS IN TABLE ADD(81) & ADD(91)
13	ITSPG=6,			" " " " " ORD(1) & ABB(1)
25	JN2=5,			" " " " " CØZ(1) & SSZ(1)
37	JN3=12,			" " " " " TQE(1) & RPM(1)
49				
61	&END			

FORM 114-G-16 (BOND)

ASTP DOCKING PROGRAM INPUT DATA

The following pages list of the load analyses, computer input data. The input data describe the docking system characteristics, docking vehicle mass properties, and vehicle control system characteristics as used for Apollo CSM docking to the Soyuz.

FORTRAN FIXED 10 DIGIT DECIMAL DATA

ASTP, 3 GUIDE DOCKING SYSTEM MODEL (HYDRAULIC)

DECK NO. ______ PROGRAMMER ______ DATE 2-13-73 PAGE 1 of 1½ JOB NO. ______

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	&INPUT	ACTIVE VEHICLE MASS PROPERTIES	NAME LIST NAME (FIRST IN FRONT OF EACH DATA DECK)
13	A=+0.0,		'A' ARRAY A(1) NOT USED
25	+954.0,		A(2) ACTIVE VEHICLE MASS (SLUGS)
37	+15767.0,		A(3) " IXX INERTIA (SLUG-FT²)
49	+81444.0,		A(4) " IYY INERTIA (SLUG-FT²)
61	+81254.0,		A(5) " IZZ INERTIA (SLUG-FT²)
1	A +2573.0,		A(6) " IXY INERTIA (SLUG-FT²)
13	-527.0,		A(7) " IXZ INERTIA (SLUG-FT²)
25	+681.0,		A(8) " IYZ INERTIA (SLUG-FT²)
37	+.48,		A(9) " Y-DIST. C.G. TO ℄ (FT)
49	+.0033,		A(10) " Z-DIST. C.G. TO ℄ (FT)
61	+19.5,		A(11) " X-DIST. C.G. TO DOCKING BASE (FT)
1	B B=+0.0,	TARGET VEHICLE MASS PROPERTIES	'B' ARRAY B(1) NOT USED
13	+465.,		B(2) TARGET VEHICLE MASS (SLUGS)
25	+3507.,		B(3) " IXX INERTIA (SLUG-FT²)
37	+18223.,		B(4) " IYY INERTIA (SLUG-FT²)
49	+17789.,		B(5) " IZZ INERTIA (SLUG-FT²)
61	-434.,		B(6) " IXY INERTIA (SLUG-FT²)
1	B +217.,		B(7) " IXZ INERTIA (SLUG-FT²)
13	-14.,		B(8) " IYZ INERTIA (SLUG-FT²)
25	+.0033,		B(9) " Y-DIST. C.G. TO ℄ (FT)
37	-.0039,		B(10) " Z-DIST. C.G. TO ℄ (FT)
49	-11.65,		B(11) " X-DIST. C.G. TO DOCKING BASE (FT)
61			

ENCLOSURE (4) 1 of 18

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 2 of 16 JOB NO. ______

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
C C = +0.0	ATTENUATOR & RING DATA	"C" ARRAY C(1) NOT USED
+2.39		C(2) DA, RADIUS TO ATTENUATOR CONNECT TO VEHICLE (FT)
+2.74		C(3) DT, RADIUS TO ATTENUATOR CONNECT TO RING (FT)
+60.		C(4) ALPHA, ANGLE TO PT. BTW ATTENUATOR PAIRS (DEG)
+1.		C(5) EXT, +1.0 EXTERNAL FINGERS, -1.0 INTERNAL FINGERS (N/D)
+0.0		C(6) NOT USED = 0.0
C +30.0		C(7) THMA, HALF ANGLE BTW ATTENUATORS - VEHICLE SIDE (DEG)
+6.5		C(8) THMT, HALF ANGLE BTW ATTENUATORS - RING SIDE (DEG)
+97800.		C(9) SKS, SPRING CONSTANT OF RING (LB/FT)
+[illegible].767		C(10) RETURN CYLINDER AREA (IN²)
+1000000.0		C(11) ~~RETURN PISTON AREA~~ MUST BE LARGE NO. (IN²)
+0.0		C(12) NOT USED
C +0.0		C(13) NOT USED
+0.0		C(14) NOT USED
+0.0		C(15) NOT USED
+12.5		C(16) FRICP, ATTENUATOR RUNNING FRICTION (LB)
+0.0		C(17) NOT USED
+0.391		C(18) ACCUMS ORIFICE BRAKE AREA (SAFO) (IN²)
C +180.	F.C. E.L.	C(19) THDEO, ~~ANGLE~~ WRT Y-AXIS TO RADIAL MISS DISTANCE (DEG)
+0.985		C(20) XMISS, MISS DISTANCE - RADIAL (FT)
+0.0		C(21) LLOAD, +1.0 PHASE I, = 0.0 PHASE II (N/D)
+1.0		C(22) CHECK, STROKE AT CHECKBALL FORCE LIMIT (FT)
+2.0		C(23) RSX, X-DIST. TO STRUCTURE CHECK PLANE AT FINGERS (FT)
+2.135		C(24) RSR, RADIUS OF STRUCTURE AT FINGERS FOR CHECK (FT)

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 3 of 16 JOB NO. ______

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
C +.12		C(25) DLGTH, ORIFICE LENGTH (IN.)
+1.22797		C(26) B, RETURN INNER CYLINDER AREA (IN^2)
+3.875 ← C(20)	.04 HOT	C(27) XKV, KINEMATIC VISCOSITY (IN^2/SEC)
+.0000948	.0000883	C(28) RHO, HYDRAULIC FLUID MASS DENSITY ($LB\text{-}SEC^2/IN^4$)
+1.22718		C(29) AC, ATTENUATOR CYLINDER AREA (IN^2)
+.19635		C(30) B, METERING PIN AREA (IN^2)
C +0.0		C(31)
+0.0		C(32)
+0.0		C(33)
+0.0		C(34)
+0.0		C(35) USED INTERNALLY FOR VECTOR STORAGE
+0.0		C(36)
C +0.0		C(37)
+0.0		C(38)
+0.0		C(39)
+0.0	I.C.	C(40) THANG, ANGLE FRM Y-AXIS TO THTOT PLANE (DEG)
+7.0	I.C.	C(41) THTOT, RELATIVE ANGLE BTW VEHICLE ℄'S (DEG)
+180.	I.C.	C(42) THVEL, ~~[illegible]~~ ANGLE WRT Y-INERTIAL (DEG)
C +.328	I.C.	C(43) VL, ACTIVE VEHICLE RADIAL VEL. WRT TARGET (FPS)
+0.0	I.C.	C(44) OMEGR, ROLL RATE WRT TARGET (°/S)
+1.0	I.C.	C(45) OMEGT, INTERFACE ANG. RATE − OMEGR (°/S)
+0.0	I.C.	C(46) THOMEL, ANGLE FRM Y-AXIS TO OMEGT PLANE (DEG)
0.0		C(47) ~~USED~~ INTERNALLY
0.0		C(48) VLMIN, USED ONLY WITH IHUNT

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 4 of 16 JOB NO. ______

		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	C	0.0		C(49) VLMAX, USED ONLY WITH IHUNT
13		0.0		C(50) VAMIN, " " " "
25				
37				
49				
61				
1	D	D = 0.0	RETRACT MECHANISM DATA	"D" ARRAY D(1) USED INTERNALLY
13		+0.0		D(2) USED INTERNALLY
25		+0.0		D(3) USED INTERNALLY
37		+0.0		D(4) NOT USED
49		+1.0		D(5) [illegible] >0, REINITIALIZES STANDARD DATA
61		+7.5		D(6) SPAN(1), LENGTH CABLE FROM MOTOR TO PULLEY (1) (FT)
1	D	+7.5		D(7) SPAN(2), " " "
13		+7.5		D(8) SPAN(3), " " "
25		+0.0		D(9) SPAN(4), " " "
37		+0.0		D(10) SPAN(5), " " "
49		+0.0		D(11) SPAN(6), " " "
61		0.0		D(12) USED INTERNALLY
1	D	+0.0		D(13) [illegible]
13		+0.0		D(14) [illegible]
25		+0.0		D(15) OMEGM, [illegible] (RAD/SEC)
37		+.198		D(16) RDRUM, CABLE DRUM RADIUS (FT)
49		-.1317		D(17) XO, DISTANCE FROM ATTENUATOR BASE TO PULLEY BASE (FT)
61		+2.38000		D(18) SKCABLE, SPRING CONSTANT OF CABLE (#/FT/FT)

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 5 of 16 JOB NO. ______

Col.		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	D	+34.0		D(19) WAIT, RETRACT START TIME (SEC)
13		-.358		D(20) XCR, DISTANCE FROM ATTACHED TO CABLE [illegible] (FT)
25		+2.54		D(21) CRADB, RADIUS TO BASE CABLE PULLEYS (FT)
37		+2.54		D(22) CRAD R, RADIUS TO RING CABLE ATTACH PT (FT)
49		+0.0		D(23) USED INTERNALLY
61		+0.60		D(24) EFF, RETRACT MOTOR GEAR EFFICENCY, (N/D)
1	D	+6560.		D(25) GEAR, GEAR RATIO $\frac{R_{OUT}}{R_{INPUT}}$ (N/D)
13		+.000213		D(26) DMOTOR, MOMENT OF INERTIA @ MOTOR SHAFT (SLUG-FT²)
25		+0.0		D(27) NOT USED
37		+0.0		D(28) NOT USED
49		+0.0	RING IVX	D(29) IV1 USED ONLY BY IHUNT
61		+0.0	RING IVY	D(30) IV2 USED ONLY BY IHUNT
1	E	E=+0.0	PLOT & PRINT CONTROL	"E" ARRAY E(1) USED INTERNALLY
13		+0.0		E(2) USED INTERNALLY
25		+7.0		E(3) STOP, PROGRAM STOP TIME (PRIOR TO CAPTURE) (SEC)
37		+0.001		E(4) MAX LOAD SEARCH INTERVAL ≤ DELP
49		+6.0		E(5) CASE NUMBER
61		+0.0		E(6) USED INTERNALLY
1	E	+.2		E(7) DELP, PROGRAM PRINT INTERVAL (SEC)
13		+0.00909		E(8) DELPLT, MINIMUM PLOT TIME (SEC)
25		+0.0		E(9) USED INTERNALLY
37		+0.0		E(10) USED INTERNALLY
49				
61				

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 6 of 16 JOB NO. ______

Col.	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	F F=+.0005	PROGRAM CONTROL DATA	"F" ARRAY, A2A, MAX. INTEG. ERROR AFTER CAPTURE
13	+.0005		F(2) TMESH, INITIAL INTEG. STEP SIZE (SEC)
25	+0.0		F(3) N, NUMBER OF STATE VARIABLES ([illegible])
37	+0.0		F(4) A3, MIN. INTEG. ERROR
49	+.01		F(5) A6, MAX. STEP SIZE (SEC)
61	+0.0		F(6) KAI, =0.0 VARIABLE STEP, =1.0 FIXED STEP A.M., =-1.0 FIXED STEP R.K.
1	F +.00001		F(7) A2, MAX. INTEG. ERROR
13	+.0003		F(8) A4, MIN. STEP SIZE BEFORE CAPTURE (SEC)
25	+.2		F(9) A7, REDUCTION FACTOR FOR STEP SIZE ([illegible])
37	+.001		F(10) A4A, MIN. STEP SIZE BEYOND CAPTURE (SEC)
49			
61			
1	G AA=+.5	[illegible] ACS DATA	"AA" ARRAY, AA(1) REACT1, TIME FROM T.C. TO X-THRUST (SEC)
13	+0.0		AA(2) THCOMA, COMMANDED ATTITUDE, PITCH (DEG)
25	+0.0		AA(3) PHCOMA, " , ROLL (DEG)
37	-2.0		AA(4) PSCOMA, " , YAW (DEG)
49	+1.0		AA(5) ARXA, RATE GAIN, ROLL (DEG/DEG/SEC)
61	+1.0		AA(6) ARYA, " , PITCH (DEG/DEG/SEC)
1	G +1.0		AA(7) ARZA, " , YAW (DEG/DEG/SEC)
13	+1.0		AA(8) ADPHA, ATTITUDE GAIN, ROLL (DEG/DEG)
25	+1.0		AA(9) ADTHA, " , PITCH (DEG/DEG)
37	+1.0		AA(10) ADPSA, " , YAW (DEG/DEG)
49	+6.96		AA(11) RADA, RADIUS TO JETS FROM ℄ (FT)
61	+98.481		AA(12) FIREA, THRUST PER JET (LB)

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 7 of 16 JOB NO. ______

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
6 +.18,		AA(13) BURNA, MINIMUM JET BURN TIME (SEC)
+.2,		AA(14) DBANXA, ATTITUDE DEAD BAND, ROLL (DEG)
+.2,		AA(15) DBANYA, " , PITCH (DEG)
+.2,		AA(16) DBANZA, " , YAW (DEG)
+1.,		AA(17) EXA, IF >0 HOLDS ATTITUDE AFTER CAPTURE LATCH
+3.,		AA(18) REACTA, X-THRUST TIME AFTER CAPTURE (SEC)
6 +1.,		AA(19) BANXA, RATE GAIN AFTER CAPTURE, ROLL (DEG/DEG/SEC)
+1.,		AA(20) BANYA, " , PITCH (DEG/DEG/SEC)
+1.,		AA(21) BANZA, " , YAW (DEG/DEG/SEC)
+0.0,		AA(22) IR, NOT USED
+1000.,		AA(23) RMAXA, ROLL ATTITUDE ERROR LIMIT (DEG)
+1000.,		AA(24) PMAXA, YAW " (DEG)
6 +1000.,		AA(25) YMAXA, PITCH " (DEG)
N AT=+100.,		"AT" ARRAY, AT(1) REACT1 TIME TO START X-THRUST (SEC)
+3.36,		AT(2) RADTY, Y DIST. TO RCS JET FROM ℄ (FT)
+3.36,		AT(3) RADTZ, Z DIST. TO RCS JET FROM ℄ (FT)
+5.52,		AT(4) FIRET, RCS JET THRUST (LB)
+.05,		AT(5) BURNT, MINIMUM BURN TIME (SEC)
+10.,		AT(6) ARXT, ROLL RATE GAIN (DEG/DEG/SEC)

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 8 of 16 JOB NO. ______

Col.		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	H	+10.	TARGET VEHICLE CONTROL SYSTEM	AT(7) ARYT, PITCH RATE GAIN (DEG/DEG/SEC)
13		+10.		AT(8) ARZT, YAW RATE GAIN (DEG/DEG/SEC)
25		+11.		AT(9) ADPHT, ROLL ATTITUDE GAIN (DEG/DEG)
37		+11.		AT(10) ADTHT, PITCH ATTITUDE GAIN (DEG/DEG)
49		+11.		AT(11) ADPST, YAW ATTITUDE GAIN (DEG/DEG)
61		+1.		AT(12) DBANXT, ROLL ATTITUDE DEAD BAND (DEG)
1	H	+1.		AT(13) DBANYT, PITCH " (DEG)
13		+1.		AT(14) DBANZT, YAW " (DEG)
25		+0.0		AT(15) THCOMT, PITCH ATTITUDE COMMAND (DEG)
37		+0.0		AT(16) PHCOMT, ROLL ATTITUDE COMMAND (DEG)
49		+0.0		AT(17) PSCOMT, YAW ATTITUDE COMMAND (DEG)
61		+.5		AT(18) REACTT, TIME X-THRUST CUTOFF AFTER CAPTURE (SEC)
1	H	+0.0		AT(19) BANXT, ROLL RATE GAIN AFTER CAPTURE (DEG/DEG/SEC)
13		+0.0		AT(20) BANYT, PITCH RATE GAIN AFTER CAPTURE (DEG/DEG/SEC)
25		+0.0		AT(21) BANZT, YAW RATE GAIN AFTER CAPTURE (DEG/DEG/SEC)
37		+.37		AT(22) DQ1, DIST. FROM C.G. TO X JETS (FT)
49		+8.59		AT(23) DQ2, DIST. FROM C.G. TO Z JETS (FT)
61		+8.59		AT(24) DQ3, DIST. FROM C.G TO Y JETS (FT)
1	H	-1.		AT(25) FMT, IF > 0 HOLDS ATTITUDE AFTER CAPTURE
13		+6.		AT(26) RMAXT, ROLL ATTITUDE ERROR LIMIT (DEG)
25		+6.		AT(27) YMAXT, PITCH ATTITUDE ERROR LIMIT (DEG)
37		+6.		AT(28) PMAXT, YAW ATTITUDE ERROR LIMIT (DEG)
49		0.0		AT(29) USED INTERNALLY
61		0.0		AT(30) USED INTERNALLY

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 9 of 16 JOB NO. ______

		NUMBER $-30°F$ (−65°F)	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	I	CO=+.314 (.180),	NUMBER OF ATTENUATORS	"CO" ARRAY CO(1) ATTENUATOR ORIFICE AREA (IN^2)
13		+.314 (.180),		CO(2) " " "
25		+.04 (.0035),		CO(3) " " "
37		+.0034 (.005),		CO(4) " " "
49		+.00185 (.00225),		CO(5) " " "
61		+.00108 (.00158),		CO(6) " " "
1	I	+.0007 (.0012),		CO(7) " " "
13		+.0007 (.0012),		CO(8) " " "
25		+ ,		CO(9) " " "
37		+ ,		CO(10) " " "
49				
61				
1	J	SS=-1.,		"SS" ARRAY SS(1) ATTENUATOR STROKE (IN)
13		+0.0,		SS(2)
25		+2.7,		SS(3)
37		+3.5,		SS(4)
49		+4.0,		SS(5)
61		+4.3,		SS(6)
1	J	+4.5,		SS(7)
13		+12.0,		SS(8)
25		+ ,		SS(9)
37		+ ,		SS(10)
49				
61				

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Space Division
Rockwell International

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ____ PROGRAMMER ____ DATE ____ PAGE 10 of 16 JOB NO. ____

Col.		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	K	T = 0.0	INITIAL CONDITIONS	"T" ARRAY T(1) XA COMPUTED INTERNALLY
13		+0.0		T(2) YA "
25		+0.0		T(3) ZA "
37		+0.0		T(4) XT "
49		+0.0		T(5) YT "
61		+0.0		T(6) ZT "
1	K	+0.0		T(7) OMEGXA,
13		+0.0		T(8) OMEGYA,
25		+0.0		T(9) OMEGZA,
37		+0.0		T(10) OMEGXT,
49		+0.0		T(11) OMEGYT,
61		+0.0		T(12) OMEGZT,
1	K	+0.0		T(13) THA,
13		+0.0		T(14) PHA,
25		+0.0		T(15) PSA,
37		+0.0		T(16) THT,
49		+0.0		T(17) PHT,
61		+0.0		T(18) PST,
1	K	+1.583		T(19) XP X-DIST FRM BASE TO TIP OF ATTAN (FT)
13		+0.0		T(20) YP AT t=0
25		+0.0		T(21) ZP,
37		+1.0		T(22) USED INTERNALLY
49		+0.0		T(23) "
61		+[illegible].0		T(24) "

NOT USED WHEN TSIMPLE IS USED.

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SD 74-CS-0023

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 11 of 16 JOB NO. ______

Col.		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	K	+.985	INITIAL CONDITIONS	T(25) XAD, ACTIVE VEHICLE INERTIAL X VEL (FPS)
11		0.0	FIXED BY CSIMAR	T(26) YAD, " Y VEL (FPS)
21		0.0		T(27) ZAD, " Z VEL (FPS)
31		0.0		T(28) XTD, TARGET VEHICLE INERTIAL X VEL (FPS)
41		0.0		T(29) YTD, " Y VEL (FPS)
51		0.0		T(30) ZTD, " Z VEL (FPS)
1	K	+1240.0		T(31) - T(42) USED INTERNALLY
11		+0.0		T(43) TIME MUST BE 0.0
21				
31				
41				
51				
1	L	ADD = .0018	[illegible] DATA	"ADD" ARRAY, ADD(1) RR, X-DIST. FROM RING C.G. TO ATTN ATTACH [illegible]
11		+0.0		ADD(2) OFFJR, Y DIST. FROM C.G. TO ℄ OF RING (FT)
21		+0.0		ADD(3) OFFKR, Z DIST. FROM C.G. TO ℄ OF RING (FT)
31		+8.07		ADD(4) XMR, MASS OF RING (SLUGS)
41		+21.5		ADD(5) XXIR, ROLL MOMENT OF INERTIA (SLUG FT²)
51		+12.2		ADD(6) YYIR, PITCH " (SLUG FT²)
1	L	+12.2		ADD(7) ZZIR, YAW " (SLUG FT²)
11		+0.0		ADD(8) USED INTERNALLY
21		-.5235987		ADD(9) APRO, ANGLE FROM Y-AXIS, COUNTERCLOCK. ABOUT X, TO FINGER 1 (RAD)
31		+2.132		ADD(10) R50, RADII OF FINGER ATTACH PT.S (FT)
41		+.0644		ADD(11) AXS, X DIST. FROM RING C.G. TO ℄ FINGER RING (FT)
51		+0.0		ADD(12) AYS, Y DIST. FROM RING C.G. TO ℄ FINGER RING (FT)

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ORIGINAL PAGE IS
OF POOR QUALITY

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 12 of 16 JOB NO. ______

		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	L	+0.0	RING & GUIDE DATA	ADD(13) AZE, Z DIST. FRM RING C.G. TO ℄ FINGER RING (FT)
13		+0.7941		ADD(14) BET, ANGLE FRM X-AXIS TO FINGER TIP (RAD)
25		+3.84		ADD(15) TIPBET, AXIAL DIST FRM RING TO FINGER TIP (FT)
37		+0.0		ADD(16) TPRO, COMPUTED INTERNALLY
49		+1.16		ADD(17) CHOP, AXIAL CUT LENGTH OF FINGERS (FT)
61		+21800.		ADD(18) SK, EQUIVALENT SPRING CONST. OF FINGERS & RING (LB/FT)
1	L	+0.0		ADD(19) USED INTERNALLY
13		+0.0		ADD(20) USED INTERNALLY
25		+8*0.0		ADD(21) THRU ADD(28) USED INTERNALLY
37		+106200.		ADD(29) SKL, LATCH & STRUCTURE SPRING CONST. (LB/FT)
49		+11*0.0		ADD(30)-(40) COZ ARRAY NOT USED
61		+9*0.0		ADD(41) THRU ADD(49) NOT USED
1	L	+0.0		ADD(50) NOT USED
13		+0.0		ADD(51)
25		+0.0		ADD(52)
37		+0.0		ADD(53)
49		+0.0		ADD(54)
61		+0.0		ADD(55)
1	L	+0.0		ADD(56) NOT USED
13		+1.583		ADD(57) XPO, ORIGINAL X DIST. OF ATTN. (FT)
25		+0.0		ADD(58) NOT USED
37		+0.0		ADD(59) USED INTERNALLY
49		+0.0		ADD(60) [illegible]
61		+10*0.0		ADD(61) THRU ADD(70) SS(2) NOT USED

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 13 of 16 JOB NO. ______

		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	L	+.325		ADD(71) XL, AXIAL DIST. FRM. FINGER PLATE TO LATCH (FT)
13		+2.34		ADD(72) RADL, RADIUS TO LATCHES (FT)
25		+0.0		ADD(73) NOT USED
37		+50.0		ADD(74) STOPL, STOP TIME AFTER TOTAL LATCH (SEC)
49		+0.007		ADD(75) HYSA, BURN HYSTERISIS ACTIVE VEHICLE (SEC)
61		+0.007		ADD(76) HYST, BURN HYSTERISIS TARGET VEHICLE (SEC)
1	L	+440.0		ADD(77)-(80) NOT USED
13		+0.0		ADD(81) ATTENUATOR TENSION SNUBBER FORCE TABLE, PT#1 (LB)
25		+50.		ADD(82) " 2 "
37		+320000.		ADD(83) " 3 "
49		+0.0		ADD(84) " 4 "
61		+0.0		ADD(85) " 5 "
1	L	+0.0		ADD(86) " 6 "
13		+0.0		ADD(87) " 7 "
25		+0.0		ADD(88) " 8 "
37		+0.0		ADD(89) " 9 "
49		+0.0		ADD(90) " 10 "
61				
1	L	+0.0		ADD(91) ATTENUATOR TENSION SNUBBER STROKE TABLE, PT 1 (FT)
13		+.001		ADD(92) " 2 "
25		+.999		ADD(93) " 3 "
37		+0.0		ADD(94) " 4 "
49		+0.0		ADD(95) " 5 "
61		+0.0		ADD(96) " 6 "

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 14 of 16 JOB NO. ______

Col.		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	L	+0.0		ADD(97) ATTANUATOR TENSION SNUBBER STROKE PT.7 (FT)
13		+0.0		ADD(98) " " " " PT.8 "
25		+0.0		ADD(99) " " " " PT.9 "
37		+0.0		ADD(100) " " " " PT.10 "
49				
61				
1	M	ORD = +0.0		ORD(1) RETURN SPRING LOAD ARRAY, PT.1 (LBS)
13		+22.5		ORD(2) " " " ", PT.2 "
25		+31.5		ORD(3) " " " ", PT.3 "
37		+302.5		ORD(4) " " " ", PT.4 "
49		+532.5		ORD(5) " " " ", PT.5 "
61		+16000.		ORD(6) " " " ", PT.6 "
1	M			ORD(7) " " " ", PT.7 "
13				ORD(8) " " " ", PT.8 "
25				ORD(9) " " " ", PT.9 "
37				ORD(10) " " " ", PT.10 "
49				
61				
1	N	ABB = +0.0		ABB(1) RETURN SPRING STROKE POINT 1 (FT)
13		+.001032		ABB(2) " " " " 2 "
25		+.468		ABB(3) " " " " 3 "
37		+.676		ABB(4) " " " " 4 "
49		+.7		ABB(5) " " " " 5 "
61		+.75		ABB(6) " " " " 6 "

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FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 15 of 16 JOB NO. ______

Col.	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	N		ABB(7) RETURN SPRING STROKE POINT 7 (FT)
13			ABB(8) " " " " 8 "
25			ABB(9) " " " " 9 "
37			ABB(10) " " " " 10 "
49			
61			
1	0 CØ= .00037		CØ2(1) RETURN ORIFICE AREA POINT 1 (IN²)
13	+.00037		CØ2(2) " " " " 2 "
25	+.00037		CØ2(3) " " " " 3 "
37	+.0011		CØ2(4) " " " " 4 "
49	+.0011		CØ2(5) " " " " 5 "
61			CØ2(6) " " " " 6 "
1	0		CØ2(7) " " " " 7 "
13			CØ2(8) " " " " 8 "
25			CØ2(9) " " " " 9 "
37			CØ2(10) " " " " 10 "
49			
61			
1	P SS2=-1.0		SS2(1) RETURN ORIFICE STROKE POINT 1 (IN)
13	+0.0		SS2(2) " " " " 2 "
25	+.937		SS2(3) " " " " 3 "
37	+1.		SS2(4) " " " " 4 "
49	+12.		SS2(5) " " " " 5 "
61			SS2(6) " " " " 6 "

FORM 110-C-17 REV. 1-00

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Space Division
Rockwell International

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 16 of 17 JOB NO. ______

Col.		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	P			SSZ(7) RETURN ORIFICE STROKE POINT 7 (IN)
13				SSZ(8) " " " " 8 "
25				SSZ(9) " " " " 9 "
37				SSZ(10) " " " " 10 "
49				
61				
1	Q	TQE*=.385		TQE (1) RETRACT MOTOR TORQUE LIMIT, 1ST POINT (FT-LBS)
13		+.385		TQE (2) " 2 "
25		+.38		TQE (3) " 3 "
37		+.375		TQE (4) " 4 "
49		+.3646		TQE (5) " 5 "
61		+.3516		TQE (6) " 6 "
1	Q	+.3282		TQE (7) " 7 "
13		+.2916		TQE (8) " 8 "
25		+.2292		TQE (9) " 9 "
37		+.1198		TQE (10) " 10 "
49		+0.0		TQE (11) " 11 "
61		+0.0		TQE (12) " 12 "
1	Q			TQE (13) " 13 "
13				TQE (14) " 14 "
25				TQE (15) " 15 "
37				
49				
61				

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[redacted]

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 17 of ___ JOB NO. ______

Col.		NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	R	RPM=0.0		RPM(1), RETRACT MOTOR RATE LIMIT, 1ST POINT (RAD/SEC)
13		+209.4		RPM(2), " , 2 "
25		+418.8		RPM(3), " , 3 "
37		+523.5		RPM(4), " , 4 "
49		+628.2		RPM(5), " , 5 "
61		+732.9		RPM(6), " , 6 "
1	R	+837.6		RPM(7), " , 7 "
13		+942.3		RPM(8), " , 8 "
25		+1047.		RPM(9), " , 9 "
37		+1151.7		RPM(10), " , 10 "
49		+1230.		RPM(11), " , 11 "
61		+1230.		RPM(12), " , 12 "
1	R			RPM(13), " , 13 "
13				RPM(14), " , 14 "
25				RPM(15), " , 15 "
37				
49				
61				
1				
13				
25				
37				
49				
61				

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INTEGER DATA

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. ______ PROGRAMMER ______ DATE ______ PAGE 1 of 2 JOB NO ______

	NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1	TTLI=48H2,3		A TITLE OR PHRASE CAN BE INSERTED
13	GUIDE HYDRA		WITH THIS CARD. LENGTH IS LIMITED TO 48
25	ULIC SYSTEM		SPACES FOLLOWING H. PLACE COMMA
37			ONLY AT END.
49	,		
61			
1	IPHASE=1,		TYPE OF CONTACT =1 CONTACT, =0 [illegible], =3 LATCHING
13	N=50,		NUMBER OF VARIABLES INTEGRATED
25	IRCS=3,		ACTIVATES ACTIVE VEHICLE RCS =1, TARGET =2, BOTH =3, NONE =0
37	IVEH=1,		TYPE CONTROL SYSTEM, LM =1 S-IVB =0
49	ISIMPL=1,		IF =1 USES SIMPLIFIED [illegible] INPUT
61	JN=8,		SET EQUAL TO NO. OF ATTEN HYD. POINTS
1	MPLOT=21,		PLOTS EVERY 'MPLOT' INTEGRATIONS
13	NFING=3,		NUMBER OF FINGERS ON RING
25	NATTEN=6,		NUMBER OF ATTENUATORS
37	IGRAPH=1,		PLOTS CRT IF =1; NO PLOTS IF =0
49	ITABLE=1,		NOT USED
61	IH=-20,		SET =10 IF BOUNDARY SEARCH IS DESIRED
1	IXTRA=3,		NUMBER OF POINTS IN TABLE ADD(81) + ADD(91)
13	IISPG=13,		NUMBER OF POINTS IN SPRING LOAD TABLE:
25	JN2=15,		NUMBER OF POINTS IN RETURN ORIFICE AREA TABLE
37	JN3=12,		NUMBER OF POINTS IN TORQUE VS. OMEGA ARRAY
49			[illegible]
61	&END		

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EXAMPLE JOB REQUEST FORM

COMPUTER JOB SUBMITTAL

JOB NAME: T D I N D 1 9 1 (D / Loc / Seq / Box)

Submitter Name: MOUNT G.O.

Bldg/Facil: DN1 — Deliv Pt: 8021 — Dept: 646 — Group: 407 — Pers Pick Up

Charge Number: 0874-07-01 — No Net — Ph. Ext.: 2-3420 — PGMNO — Use Code

COMPILE ONLY

Expected Wall Clock Time: 60 Min
CRT Camera: 45
CRT Magnification: 9X9

JOB LIMITS — Lines: 39.0 (100'S) — Frames: 0 (10'S)
TIME = 60 (Min) . (Sec)

	DATE	TIME	BY
SUBMITTED	5/10/74	09:0	
Received			
KP/Ver			
Set Up			
Load			
Complete			
Mailed			

, REGION = 230 K
, CLASS = C
, MSGLEVEL = 1

Trailing Comma

PRIORITY/SIGNATURE

A B C D

[X] DECK IS COMPLETE

	ON FILE	ENCLOSED	KEY PUNCH (PAGES)	DECK NAME	INTERP KP	DUPES OK	KP ONLY	ALT CARDS	PUNCH AT FLAG
7									
6									
5									
4									
3									
2									
1									

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OUTPUT DATA

The output data from this program are in two forms: (1) numerical printout of docking loads and motion and (2) cathode-ray tube (CRT) plotted docking loads and motion time histories. The following pages are an example of printed and plotted program output and are followed by definitions of each data symbol and its units.

The user has considerable responsibility in controlling program output as described in the description column of the input data sheets. Integration step size, output printing, and plotting intervals, as well as the various program stop times, can all be specified in the input data by the user and will materially affect solution accuracy, output volume, computer run time, and resulting cost. A long run time and a small print interval will get you 50 to 100 pounds of printout paper, most of which you will not want.

Normal printed output for each case will look like the example: six pages of printed input data, and two pages at each time point during the run. The CRT data output will be approximately 50 pages of plotted time histories. If certain parameters remain zero throughout the run, their plots will not be included in the CRT.

PRINTED OUTPUT DATA NOMENCLATURE DEFINITION

Name	Definition	Units
TIME	Current time during docking dynamics	sec
CASE	Case number, i.e., .60000000E01 = Case 6	N/A
XADD YADD ZADD	Acceleration vector of CSM WRT inertial frame	ft/sec^2
XTDD YTDD ZTDD	Acceleration vector of Soyuz WRT inertial frame	ft/sec^2
XAD YAD ZAD	Velocity vector of CSM WRT inertial frame	ft/sec
XTD YTD ZTD	Velocity vector of Soyuz WRT inertial frame	ft/sec

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Name	Definition	Units
XA YA ZA	Position vector of CSM C.G. WRT inertial frame	ft
XT YT ZT	Position vector of Soyuz C.G. WRT inertial frame	ft
OXA OYA OZA	Angular rate of CSM about its body axis	deg/sec
OXT OYT OZT	Angular rate of Soyuz about its body axis	deg/sec
PHAD THAD PSAD	Angular Euler rate of CSM	deg/sec
PHTD THTD PSTD	Angular Euler rate of Soyuz	deg/sec
PHA THA PSA	Euler angles of CSM	deg
PHT THT PST	Euler angles of Soyuz vehicle	deg
FSAX FSAY FSAZ	Force vector acting on CSM Referred to CSM body coordinate system	lb
FSTX FSTY FSTZ	Force vector acting on Soyuz Referred to Soyuz body coordinate system	lb
TSXA TSYA TSZA	Torque vector acting on CSM Referred to CSM body coordinate system	ft-lb
TSXT TSYT TSZT	Torque vector acting on Soyuz Referred to Soyuz body coordinate system	ft-lb

Name	Definition	Units
FRX FRY FRZ	Force vector acting on ring Referred to ring coordinate system	lb
TRX TRY TRZ	Torque vector acting on ring Referred to ring coordinate system	ft-lb
XRDD YRDD ZRDD	Vector acceleration of ring Referred to inertial coordinate system	ft/sec^2
ANXR ANYR ANZR	Angular rate vector of ring Referred to ring coordinate system	deg/sec
XRD YRD ZRD	Velocity veccor of ring Referred to inertial coordinate system	ft/sec
PHRD THRD PSRD	Euler rate of ring	deg/sec
XR YR ZR	Position vector of ring Referred to inertial coordinate system	ft
PHR THR PSR	Euler angle of ring	deg
FCAX FCAY FCAZ	Attitude control force vector of CSM Referred to CSM body coordinate system	lb
FCTX FCTY FCTZ	Attitude control force vector of Soyuz Referred to Soyuz body coordinate system	lb
TCAX TCAY TCAZ	Attitude control torque vector of CSM Referred to CSM body coordinate system	ft-lb
TCTZ TCTY TCTZ	Attitude control torque vector of Soyuz Referred to Soyuz body coordinate system	ft-lb

Name	Definition	Units
RWRTA1 RWRTA2 RWRTA3	Position vector of geometric center of ring with respect to geometric center of attenuator attach plane	ft
RWRTT1 RWRTT2 RWRTT3	Position vector of geometric center of ring with respect to geometric center of mating ring on Soyuz referred to Soyuz body coordinate system	ft
VWRTA1 VWRTA2 VWRTA3	Velocity vector of geometric center of ring with respect to CSM coordinate system	ft-sec
VWRTT1 VWRTT2 WRRTT3	Velocity vector of geometric center of ring with respect to Soyuz coordinate system	ft-sec
AWRTA1 AWRTA2 AWRTA3	Euler attitude of ring with respect to CSM	deg
AWRTTL AWRTT2 AWRTT3	Euler attitude of ring with respect to Soyuz	deg
OWRTA1 OWRTA2 OWRTA3	Angular rate of ring with respect to CSM	deg-sec
OWRTT1 OWRTT2 OWRTT3	Angular rate of ring with respect to Soyuz	deg-sec
ATTNX(I) ATTNY(I) ATTNZ(I)	X-Y-Z components of vector length of six attenuators with respect to active body coordinate system	ft
ATTN(I)	Absolute length of the six attenuators	
STR(I)	Axial stroke of attenuators (+compressive)	ft
ATTND(I)	Attenuator stroking velocity (+compressive)	ft-sec
FA(I)	Axial force in attenuators (+compressive)	lb
FINGER-R	Distance from ring base along guide edge to point of load application - CSM side	ft
FFTX FFTY FFTZ	Guide force components, guide-axis system on Soyuz	lb

Name	Definition	Units
FFRZ FFRY FFRZ	Guide force components, ring axis system on CSM	lb
DIS-1	Distance to contact normal to CSM system guide edge, (-) is in contact	ft
FINGER-T	Distance from ring base along guide edge to point of load application - Soyuz side	ft
ANGLE-R	Angle from +Y Axis to point of contact around the CSM system ring	deg
RFTX RFTY RFTZ	Ring force on Soyuz guide, guide axis system on Soyuz	lb
RFRX RFRY RFRZ	Ring force on CSM ring, in ring axis system	lb
DIS-2	Distance to contact normal to CSM ring edge (-) is in contact	ft
ANGLE-T	Angle from +Y axis to point of contact around the Soyuz ring	deg
FINGER-A	Distance from ring base along guide edge to point of load application - CSM side	ft
FRTX FRTY FRTZ	Force on Soyuz ring, in the Soyuz axis system	lb
FRRX FRRY FRRZ	Force on CSM guides, in the axis system of the CSM ring	lb
FRRX1 FRRX2 FRRX3 FRRX4 FRRX5 FRRX6	Force on the Soyuz ring surface number 1, 2, 3, etc. in compression (-)	lb
DIS-3	Distance to contact normal to the CSM guide edge (-) is in contact	ft

Name	Definition	Units
DELTAL	(-) distance capture latch would penetrate latching surface if not loaded, (+) no contact	ft
LATCHL	(-) distance along 45-degree latching surface (+) no contact	ft
LATCH LOADS BEARING	Capture latch loads in bearing on a surface that is 45-degree off the target vehicle X axis between target guides	lb
FRR,TRR	Guide ring loads, ring-to-ring contact	lb

```
TD1ND18
JOB 032
FTO6FOO
```

```
OUTPUT -0.1000E+01 -0.9998E-74  0.1071E+01  0.2303E-68
OUTPUT -0.2000E+01 -0.1000E+01  0.1741E+01  0.1071E+01
OUTPUT  0.5978E+00 -0.2000E+01 -0.9142E-01  0.1741E+01
OUTPUT  0.4682E+00  0.5978E+00  0.4044E-03 -0.9142E-01
```

***** ADD - ARRAY ****

0.180000E-02	0.0	0.0	0.161400E+02	0.430000E+02	0.244000E+02
0.244000E+02	0.000002E-78	0.104720E+01	0.213200E+01	0.644000E-01	0.0
0.0	0.907570E+00	0.412000E+01	0.0	0.116000E+01	0.218000E+05
0.404358E-03	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.119000E+06	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.158300E+01	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.000002E-78	0.325000E+00	0.234000E+01
0.0	0.0	0.700000E-02	0.700000E-02	0.0	0.0
0.0	0.0	0.0	0.400000E+02	0.320000E+06	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.100000E-02	0.999000E+00	0.0	0.0	0.0
0.0	0.0	0.0	0.0		

**** INITIAL CONDITIONS ****
CASE NO.2, ORBITER DOCKING, ASTP SYSTEM

ACTIVE VEHICLE

OMEGXA	-0.69476022E-10	PHA	0.0	OMEGYA	-0.99999982E+00	THA	0.49999981E+01
OMEGZA	0.31517163E-06	PSA	-0.15698924E-05	XAD	0.50000000E+00	XA	-0.24525162E+02
YAD	-0.31397882E-07	YA	-0.16599935E+00	ZAD	-0.10000002E+00	ZA	-0.73886261E+02
XMA	0.73700000E+04	XXIA	0.68650000E+07	YYIA	0.67380000E+07	ZZIA	0.85600000E+06
XYIA	0.99999993E-03	XZIA	-0.25199997E+00	YZIA	0.20000001E-02	OFFJA	0.83000004E-01
OFFKA	0.37800003E+02	RA	0.94700003E+01				

TARGET VEHICLE

OMEGXT	0.0	PHT	0.0	OMEGYT	0.0	THT	0.0
OMEGZT	0.0	PST	0.0	XMT	0.73700000E+04	XXIT	0.68650000E+07
YYIT	0.67380000E+07	ZZIT	0.85600000E+06	XYIT	0.99999993E-03	XZIT	-0.25199997E+00
YZIT	0.20000001E-02	OFFJT	-0.83000004E-01	OFFKT	-0.37800003E+02	RT	-0.94700003E+01

C-ARRAY/ ATTENUATOR DATA

NO ATTENUATORS = 6

0.000003E-78	0.239000E+01	0.274000E+01	-0.300000E+02	0.100000E+01	0.0
0.300000E+02	-0.650000E+01	0.978000E+05	0.176700E+01	0.780000E-03	0.0
0.0	0.0	0.0	0.125000E+02	0.0	0.391000E+00
0.900000E+02	0.500000E+00	0.0	0.100000E+01	0.0	0.213500E+01
0.120000E+00	0.122797E+01	0.449500E-01	0.883000E-04	0.122718E+01	0.196350E+00
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.900000E+02	0.500000E+01	0.900000E+02
-0.100000E+00	0.0	-0.100000E+01	0.900000E+02	0.000001E-78	0.0
0.0	0.0				
0.192733E+01	0.192733E+01				

D - ARRAY

0.786921E+00	0.377703E-06	-0.508360F+00	0.0	0.0	0.750000E+01
0.750000E+01	0.750000E+01	0.0	0.0	0.0	0.0
0.0	-0.723700E+76	0.0	0.198000E+00	-0.111700E+00	0.234000E+06
0.100000E+03	-0.358000E+00	0.254000E+01	0.254000E+01	0.100000E+01	0.600000E+00
0.656000E+04	0.273000E-03	0.0	0.0	0.0	0.0

-0.600000E+02	0.0	0.599999E+02	0.120000E+03	0.180000E+03	0.240000E+03
-0.834999E+02	0.235000E+02	0.365000E+02	0.143500E+03	0.156500E+03	0.263500E+03
0.119500E+01	0.239000F+01	0.119500E+01	-0.119500E+01	-0.239000E+01	-0.119500E+01
-0.206980E+01	0.0	0.206980E+01	0.206980E+01	0.605922E-05	-0.206980E+01
0.310180E+00	0.251274E+01	0.220257E+01	-0.220257E+01	-0.251274E+01	-0.310181E+00
-0.272239E+01	0.109257E+01	0.162981E+01	0.162982E+01	0.109257E+01	-0.272239E+01

PROGRAM COMMANDS

IPHASE	1	STOP	0.80000000E+01	DELPP	0.0	CASE	0.0
IGRAPH	1	DELP	0.19999999E+00	DESLC	0.72727241E-02	JN	
MPLOT	15						

INTEGRATION DATA

THESH	0.29999996E-03	N	50	A3	0.0	A5	0.10000002E-01
KA1	0	A2	0.99999997E-05	A4	0.29999996E-03	A7	0.19999999E+00
A2A	0.50000008E-03	A4A	0.99999993E-03				

REACTION CONTROL SYSTEM

ACTIVE CONTROL SYSTEM

THCOMA	0.50000000E+01	PHCOMA	0.0	PSCOMA	-0.15698934E-05	ARXA	0.69999999E+00
ARYA	0.69999999E+00	ARZA	0.69999999E+00	ADPHA	0.10000000E+01	ADTHA	0.10000000E+01
ADPSA	0.10000000E+01	RDA	0.0	FRA	0.90000000E+03	BRA	0.22999998E-01
DBANXA	0.43000001E+00	DBANYA	0.43000001E+00	DBANZA	0.43000001E+00	TMA	0.10000000E+01
REACTA	0.50000000E+00	BANXA	0.69999999E+00	BANYA	0.69999999E+00	BANZA	0.69999999E+00
IR	0	RMAXA	0.10000000E+02	YMAXA	0.10000000E+02	PMAXA	0.10000000E+02
REACTIA	0.50000000E+00						

TARGET CONTROL SYSTEM

RADTY	0.0	RDTZ	0.0	FIRET	0.90000000E+03	BRT	0.22999998E-01
ARXT	0.69999999E+00	ARYT	0.69999999E+00	ARZT	0.69999999E+00	ADPHT	0.10000000E+01
ADTHT	0.10000000E+01	ADPST	0.10000000E+01	DBANXT	0.43000001E+00	DBANYT	0.43000001E+00
DBANZT	0.43000001E+00	THCOMT	0.0	PHCOMT	0.0	PSCOMT	0.0
REACTT	0.50000000E+00	BANXT	0.0	BANYT	0.0	BANZT	0.0
DQ1	0.0	DQ2	0.0	DQ3	0.0	TMT	-0.10000000E+01
RMAXT	0.10000000E+02	YMAXT	0.10000000E+02	PMAXT	0.10000000E+02	IRCS	3
IVEH	1	REACTIT	0.10000000E+03				

SIMPLIFIED INITIAL CONDITIONS

THANG	0.90000000E+02	THTOT	0.50000000E+01	THVEL	0.90000000E+02	VELLAT	-0.10000002E+00
OMEGR	0.0	OMEGT	-0.10000000E+01	THOMEG	0.90000000E+02	VAXIAL	0.50000000E+00
XMISS	0.50000000E+00	THDRO	0.89999969E+02				

STROKE VS AREA TABLE

-0.10000000E+01	0.31400001E+00
0.0	0.31400001E+00
0.26999998E+01	0.10000002E-01
0.35000000E+01	0.34000000E-02
0.40000000E+01	0.18499999E-02
0.43000002E+01	0.10800001E-02
0.45000000E+01	0.69999998E-03
0.12000000E+02	0.69999998E-03

ATTENUATOR SPRING LOAD TABLE

0.0	0.0
0.10319999E-02	0.22500000E+02
0.46799999E+00	0.31500000E+02
0.67600000E+00	0.30250000E+03
0.69999999E+00	0.33250000E+03
0.75000000E+00	0.16000000E+05

RETURN ORIFICE AREA TABLE

-0.10000000E+01	0.19999999E-02
0.0	0.19999999E-02
0.93699998E+00	0.19999999E-02
0.10000000E+01	0.19999999E-02
0.12000000E+02	0.19999999E-02

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**** PRELATCH FINGER CONTACT ****

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TIME 0.0            PHASE         1 II           1 XL    0.0          THP1 0.0
XADD 0.249409E-12 YADD 0.300534E-14 ZADD 0.142438E-12 XTDD 0.0          YTDD 0.0           ZTDD 0.0
XAD  0.500000E+00 YAD -0.313979E-07 ZAD -0.100000E+00 XTD  0.0          YTD  0.0           ZTD  0.0
XA  -0.245252E+02 YA  -0.165999E+00 ZA  -0.738863E+02 XT   0.0          YT   0.0           ZT   0.0
OXA -0.694760E-10 OYA -0.100000E+01 OZA  0.315172E-06 OXT  0.0          OYT  0.0           OZT  0.0
PHAD 0.275044E-07 THAD-0.100000E+01 PSAD 0.316375E-06 PHTD 0.0          THTD 0.0           PSTD 0.0
PHA  0.0          THA  0.500000E+01 PSA -0.156989E-05 PHT  0.0          THT  0.0           PST  0.0
FSAX 0.173966E-08 FSAY 0.221472E-10 FSAZ 0.120598E-08 FSTX 0.0          FSTY 0.0           FSTZ 0.0
TSXA-0.259459E-09 TSYA 0.0          TSZA 0.0          TSXT 0.0          TSYT 0.0           TSZT 0.0
FRX -0.173966E-08 FRY -0.221472E-10 FRZ -0.120598E-08 TRX -0.477609E-09 TRY -0.190792E-08 TRZ  0.708813E-09
XRDD-0.113888E-09 YRDD-0.137219E-11 ZRDD-0.650414E-10 ANXR-0.694760E-10 ANYR-0.100000E+01 ANZR 0.315172E-06
XRD -0.140413E+00 YRD  0.469853E-07 ZRD  0.149645E+00 PHRD 0.275044E-07 THRD-0.100000E+01 PSRD 0.316375E-06
XR  -0.102216E+02 YR  -0.829998E-01 ZR  -0.371933E+02 PHR  0.0          THR  0.500000E+01 PSR -0.156989E-05
FCAX 0.0          FCAY 0.0          FCAZ 0.0          FCTX 0.0          FCTY 0.0           FCTZ 0.0
TCAX 0.0          TCAY 0.182520E+06 TCAZ 0.149402E+03 TCTX 0.0          TCTY 0.0           TCTZ 0.0
  RWRTA1  0.15829782E+01   RWRTA2 -0.59604645E-07   RWRTA3 -0.30517578E-04
  RWRTT1 -0.68739700E+00   RWRTT2  0.23841858E-06   RWRTT3  0.60112000E+00
  VWRTA1 -0.41723251E-06   VWRTA2  0.0              VWRTA3  0.35762787E-06
  VWRTT1 -0.14031535E+00   VWRTT2  0.47336837E-07   VWRTT3  0.15076500E+00
  AWRTA1  0.0              AWRTA2  0.0              AWRTA3  0.0
  AWRTT1  0.0              AWRTT2  0.49999914E+01   AWRTT3 -0.15698924E-05
  OWRTA1  0.49696164E-16   OWRTA2  0.0              OWRTA3 -0.20355549E-12
  OWRTT1 -0.12722218E-13   OWRTT2 -0.99999982E+00   OWRTT3  0.31397821E-06
ATTNX(I)     0.1582978E+01  0.1582978E+01  0.1582978E+01  0.1582978E+01  0.1582978E+01  0.1582978E+01
ATTNY(I)    -0.8848200E+00  0.1227436E+00  0.1007564E+01 -0.1007568E+01 -0.1227427E+00  0.8848221E+00
ATTNZ(I)    -0.6526003E+00  0.1092555E+01 -0.4400005E+00 -0.4400015E+00  0.1092550E+01 -0.6526012E+00
ATTN(I)      0.1927333E+01  0.1927320E+01  0.1927330E+01  0.1927334E+01  0.1927317E+01  0.1927334E+01
STR(I)       0.0            0.0            0.0            0.0            0.0            0.0
ATTND(I)     0.2858063E-06 -0.8069026E-07  0.2599677E-06  0.2599675E-06 -0.6845039E-07  0.2858063E-06
FA(I)        0.3381797E-11 -0.1235300E-08  0.2797968E-11  0.0           -0.8889607E-09  0.0
**** CONTACT BETWEEN RING FINGERS AND TARGET FINGERS
FINGER-R     0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFTX   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFRX   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFTY   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFRY   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFTZ   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFRZ   0.0            0.0            0.0            0.0            0.0            0.0
DIS-1        0.3853999E+00  0.3854001E+00  0.8963107E+00  0.1189568E+00  0.1189569E+00  0.8963132E+00
FINGER-T     0.0            0.0            0.0            0.0            0.0            0.0
**** CONTACT BETWEEN RING AND TARGET FINGERS
ANGLE-R      0.0            0.0            0.0            0.0            0.0            0.0
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FINGER-T     0.0             0.0             0.0             0.0             0.0             0.0
FORCE-RFTX   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-RFRX   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-RFTY   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-RFRY   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-RFTZ   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-RFRZ   0.0             0.0             0.0             0.0             0.0             0.0
DIS-2        0.1059511E+01  0.1481057E+01  0.1481057E+01  0.1059513E+01  0.5378723E-03  0.5359650E-03
**** CONTACT BETWEEN FINGERS ON RING AND TARGET RING
ANGLE-T      0.0             0.0             0.0             0.0             0.0             0.0
FINGER-A     0.0             0.0             0.0             0.0             0.0             0.0
FORCE-FRTX   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-FRRX   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-FRTY   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-FRRY   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-FRTZ   0.0             0.0             0.0             0.0             0.0             0.0
FORCE-FRRZ   0.0             0.0             0.0             0.0             0.0             0.0
RING TO RING CONTACT LOADS
FRRX1 0.0          FRRX2 0.0          FRRX3 0.0          FRRX4 0.0          FRRX5 0.0          FRRX6 0.0
DIS-3         0.5407391E+00  0.5407410E+00  0.8382673E+00  0.9790125E+00  0.9790125E+00  0.8382692E+00
**** LATCH DISTANCE AND FORCES
DELTAL        0.3098571E+00  0.6303748E+00  0.6303695E+00
 LATCHL       0.1019331E+01  0.2661842E+00  0.2661881E+00
LATCH LOADS
BEARING              0.0              0.0              0.0

IHIT                 0             0             0
**** INTERACTION FORCE ON RING EXCLUDING ATTENUATOR FORCE
FRR,TRR       0.0            0.0            0.0            0.0            0.0            0.0
*** CURRENT MAX ATTNEUATOR FORCES FOLLOWED BY MIN ATTENUAATOR FORCES ****
 0.33817966E-11 0.0             0.27979685E-11 0.0             0.0             0.0
 0.0             -0.12353003E-08 0.0            0.0             -0.88896068E-09 0.0
              0.5934701E-01  0.2211734E+00  0.9891170E-01  0.0             0.2357339E+00  0.0
***** TARGET FINGER DISTANCE FROM CSM STRUCTURE
 0.63397503E+00 0.60719166E+01-0.14097776E+01 0.39868069E+00 0.59062433E+01-0.24305954E+01
-0.23389721E+00 0.54667492E+01-0.16877689E+01 0.0             0.0             0.0
TAI,TTI       0.4776088E-09 -0.5242937E-07 -0.1004011E-09  0.0            0.0            0.0
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TIME 0.200132E+00 PHASE          1 II            677 XL   0.0            THP1 0.0
XADD-0.934641E-02 YADD-0.305173E-04 ZADD-0.444473E-02 XTDD 0.953810E-02 YTDD 0.267655E-04 ZTDD 0.834404E-02
XAD  0.499273E+00 YAD -0.185813E-05 ZAD -0.100016E+00 XTD  0.355217E-03 YTD  0.998884E-06 ZTD  0.310739E-03
XA  -0.244251E+02 YA  -0.165999E+00 ZA  -0.739063E+02 XT   0.842884E-05 YT   0.324029E-07 ZT   0.737333E-05
OXA  0.143332E-05 OYA -0.691086E+00 OZA  0.202225E-02 OXT  0.688740E-06 OYT -0.590249E-03 OZT  0.861971E-05
PHAD 0.172324E-03 THAD-0.691086E+00 PSAD 0.202925E-02 PHTD 0.688738E-06 THTD-0.590249E-03 PSTD 0.861970E-05
PHA  0.173584E-04 THA  0.483082E+01 PSA  0.201016E-03 PHT  0.361576E-07 THT -0.140063E-04 PST  0.152997E-06
FSAX-0.658797E+02 FSAY-0.224683E+00 FSAZ-0.384423E+02 FSTX 0.702958E+02 FSTY 0.197262E+00 FSTZ 0.614956E+02
TSXA 0.519566E+01 TSYA-0.217681E+04 TSZA 0.326285E+01 TSXT 0.220060E+01 TSYT-0.186378E+04 TSZT 0.346214E+01
FRX  0.101128E+01 FRY  0.276350E-01 FRZ -0.287548E+02 TRX  0.106421E+00 TRY -0.872339E+01 TRZ  0.751476E-01
XRDD-0.875300E-01 YRDD 0.171317E-02 ZRDD-0.178054E+01 ANXR 0.246379E-02 ANYR-0.626548E+00 ANZR-0.125838E-02
XRD  0.295072E-01 YRD  0.378067E-03 ZRD  0.152105E-01 PHRD 0.235746E-02 THRD-0.626548E+00 PSRD-0.126328E-02
XR  -0.102307E+02 YR  -0.829667E-01 ZR  -0.371727E+02 PHR  0.386412E-04 THR  0.482856E+01 PSR  0.158548E-03
FCAX 0.0          FCAY 0.0          FCAZ 0.0          FCTX 0.0          FCTY 0.0          FCTZ 0.0
TCAX 0.0          TCAY 0.182520E+06 TCAZ 0.149402E+03 TCTX 0.0          TCTY 0.0          TCTZ 0.0
  PWRTA1  0.15823374E+01   RWRTA2 -0.57220459E-05   RWRTA3 -0.15411377E-02
  RWRTT1 -0.69654846E+00   RWRTT2  0.33497810E-04   RWRTT3  0.62194824E+00
  VWRTA1 -0.21882415E-01   VWRTA2 -0.75902790E-05   VWRTA3 -0.58033943E-01
  VWRTT1  0.28821856E-01   VWPTT2  0.37662266E-03   VWRTT3  0.15698999E-01
  AWRTA1  0.24859241E-04   AWRTA2 -0.22607923E-02   AWRTA3 -0.42316795E-04
  TWRTA1  0.38604936E-04   AWRTT2  0.48285637E+01   AWRTT3  0.15839204E-03
  OWRTA1  0.24627715E-02   OWRTA2  0.64538836E-01   OWRTA3 -0.32804557E-02
  OWRTT1  0.23501317E-02   OWRTT2 -0.62595713E+00   OWRTT3 -0.14703397E-02
ATTNX(I)     0.1582444E+01  0.1582294E+01  0.1582273E+01  0.1582271E+01  0.1582292E+01  0.1582443E+01
ATTNY(I)    -0.8848236E+00  0.1227384E+00  0.1007558E+01 -0.1007574E+01 -0.1227488E+00  0.8848175E+00
ATTNZ(I)    -0.6541119E+00  0.1091046E+01 -0.4415083E+00 -0.4415112E+00  0.1091040E+01 -0.6541138E+00
ATTN(I)      0.1927408E+01  0.1925902E+01  0.1927094E+01  0.1927101E+01  0.1925898E+01  0.1927405E+01
STR(I)      -0.8155587E-04  0.1414603E-02  0.2309918E-03  0.2265801E-03  0.1418108E-02 -0.7717164E-04
ATTND(I)     0.8284510E-03  0.4966795E-01  0.3122280E-02  0.3204724E-02  0.5001965E-01  0.7480748E-03
FA(I)       -0.5040209E+01  0.3502499E+02  0.1007182E+02  0.9879483E+01  0.3502519E+02 -0.4769267E+01
**** CONTACT BETWEEN RING FINGERS AND TARGET FINGERS
FINGER-R     0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFTX   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFRX   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFTY   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFRY   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFTZ   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FFRZ   0.0            0.0            0.0            0.0            0.0            0.0
DIS-1        0.3793119E+00  0.3793609E+00  0.9186038E+00  0.1204597E+00  0.1204992E+00  0.9186298E+00
FINGER-T     0.0            0.0            0.0            0.0            0.0            0.0
**** CONTACT BETWEEN RING AND TARGET FINGERS
ANGLE-R      0.0            0.0            0.0            0.0            0.1158279E+03  0.6417369E+02
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FINGER-T     0.0            0.0            0.0            0.0            0.8821180E+00  0.8821301E+00
FORCE-RFTX   0.0            0.0            0.0            0.0            0.4634271E+02  0.4691156E+02
FORCE-RFRX   0.0            0.0            0.0            0.0           -0.3223701E+02 -0.3263297E+02
FORCE-RFTY   0.0            0.0            0.0            0.0            0.2574677E+01  0.2606033E+01
FORCE-RFRY   0.0            0.0            0.0            0.0            0.1616257E+02 -0.1635968E+02
FORCE-RFTZ   0.0            0.0            0.0            0.0            0.1616246E+02 -0.1635977E+02
FORCE-RFRZ   0.0            0.0            0.0            0.0           -0.3339238E+02 -0.3380209E+02
DIS-2        0.1077358E+01  0.1499614E+01  0.1499631E+01  0.1077394E+01 -0.2986908E-02 -0.3025055E-02
**** CONTACT BETWEEN FINGERS ON RING AND TARGET RING
ANGLE-T      0.0            0.0            0.0            0.0            0.0            0.0
FINGER-A     0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FRTX   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FRRX   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FRTY   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FRRY   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FRTZ   0.0            0.0            0.0            0.0            0.0            0.0
FORCE-FRRZ   0.0            0.0            0.0            0.0            0.0            0.0
RING TO RING CONTACT LOADS
FRRX1 0.0          FRRX2 0.0          FRRX3 0.0          FRRX4 0.0          FRRX5 0.0          FRRX6 0.0
DIS-3        0.5186033E+00  0.5185757E+00  0.8586960E+00  0.1012157E+01  0.1012206E+01  0.8587799E+00
**** LATCH DISTANCE AND FORCES
DELTAL       0.2947301E+00  0.6475390E+00  0.6474986E+00
 LATCHL      0.1037803E+01  0.2671532E+00  0.2672085E+00
LATCH LOADS
BEARING           0.0            0.0            0.0

INIT              0              0              0
**** INTERACTION FORCE ON RING EXCLUDING ATTENUATOR FORCE
FRR,TRR    -0.6486998E+02 -0.1971130E+00 -0.6719447E+02  0.2821629E-05 -0.1201606E+03  0.3532715E+00
*** CURRENT MAX ATTNEUATOR FORCES FOLLOWED BY MIN ATTENUAATOR FORCES ****
 0.70763540E+01 0.35024994E+02 0.13071083E+02 0.12996622E+02 0.35025192E+02 0.71555147E+01
-0.61367035E+01-0.61217775E+01 0.0            0.0           -0.60710802E+01-0.58463106E+01
          0.5934701E-01  0.2139788E+00  0.9891170E-01  0.5934701E-01  0.2357339E+00  0.0
***** TARGET FINGER DISTANCE FROM CSM STRUCTURE
 0.64649582E+00 0.63832870E+01-0.13954248E+01 0.40789038E+00 0.59058228E+01-0.24503927E+01
-0.23449898E+00 0.54412613E+01-0.16823215E+01 0.0            0.0            0.0
TAI,TTI     -0.1065140E+00 -0.1115364E+03  0.2784758E+00 -0.1517706E+00  0.2110425E+03 -0.5043411E+00
```

VARIABLE		MAXIMUM VALUE	AT TIME	MINIMUM VALUE	AT TIME
XAD	FT/SEC	0.5000000E+00	0.0	0.4981481E+00	0.3242620E+00
YAD	FT/SEC	-0.3139788E-07	0.0	-0.6379736E-05	0.3242620E+00
ZAD	FT/SEC	-0.9988260E-01	0.1433451E+00	-0.1005765E+00	0.3242620E+00
XTD	FT/SEC	0.1274545E-02	0.3242620E+00	0.0	0.0
YTD	FT/SEC	0.5267813E-05	0.3242620E+00	0.0	0.0
ZTD	FT/SEC	0.1114971E-02	0.3242620E+00	0.0	0.0
XRD	FT/SEC	0.1232032E+00	0.3242620E+00	-0.1404133E+00	0.0
YRD	FT/SEC	0.5667065E-03	0.2982539E+00	0.4698527E-07	0.0
ZRD	FT/SEC	0.1496453E+00	0.0	-0.1027970E+00	0.2833921E+00
XA	FT	-0.2436324E+02	0.3242620E+00	-0.2452516E+02	0.0
YA	FT	-0.1659994E+00	0.0	-0.1659999E+00	0.3202763E+00
ZA	FT	-0.7388626E+02	0.0	-0.7391870E+02	0.3242620E+00
XT	FT	0.1175433E-03	0.3242620E+00	0.0	0.0
YT	FT	0.3806531E-06	0.3242620E+00	0.0	0.0
ZT	FT	0.1028258E-03	0.3242620E+00	0.0	0.0
XR	FT	-0.1022155E+02	0.0	-0.1023176E+02	0.1506282E+00
YR	FT	-0.8291286E-01	0.3242620E+00	-0.8299977E-01	0.0
ZR	FT	-0.3717259E+02	0.2094209E+00	-0.3719328E+02	0.0
OMEGXA	DEG/SEC	0.5700468E-05	0.3242620E+00	-0.6947602E-10	0.0
OMEGYA	DEG/SEC	-0.5006242E+00	0.3242620E+00	-0.9999998E+00	0.0
OMEGZA	DEG/SEC	0.3286440E-02	0.3242620E+00	0.3151716E-06	0.0
OMEGXT	DEG/SEC	0.6307793E-05	0.3242620E+00	0.0	0.0
OMEGYT	DEG/SEC	0.0	0.0	-0.2118043E-02	0.3242620E+00
OMEGZT	DEG/SEC	0.2318664E-04	0.2833921E+00	-0.3663952E-06	0.1433451E+00
OMEGXR	DEG/SEC	0.3623242E-02	0.2168096E+00	-0.1237685E-02	0.2463663E+00
OMEGYR	DEG/SEC	-0.2775496E-01	0.2610994E+00	-0.1032049E+01	0.1433451E+00
OMEGZR	DEG/SEC	0.7655509E-02	0.3242620E+00	-0.2533917E-02	0.3056847E+00
PHA	DEG	0.4535296E-04	0.3242620E+00	0.0	0.0
THA	DEG	0.4999998E+01	0.0	0.4756840E+01	0.3242620E+00
PSA	DEG	0.5320325E-03	0.3242620E+00	-0.1569892E-05	0.0
PHT	DEG	0.3421204E-06	0.3242620E+00	0.0	0.0

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OF POOR QUALITY

THT DEG	0.0	0.0	-0.1953215E-03	0.3242620E+00
PST DEG	0.2554549E-05	0.3242620E+00	-0.6317983E-08	0.1506282E+00
PHR DEG	0.2102508E-03	0.3242620E+00	-0.3614572E-05	0.8220649E-01
THR DEG	0.4999998E+01	0.0	0.4785947E+01	0.3242620E+00
PSR DEG	0.2617426E-03	0.3242620E+00	-0.2691184E-05	0.3033599E-01
FSUMAX LBS	0.1739658E-08	0.0	-0.8649184E+02	0.2315869E+00
FSUMAY LBS	0.2214723E-10	0.0	-0.4157391E+00	0.3242620E+00
FSUMAZ LBS	0.1055735E+02	0.5822357E-01	-0.4260629E+02	0.3202763E+00
FSUMTX LBS	0.7298570E+02	0.2094209E+00	0.0	0.0
FSUMTY LBS	0.4157556E+00	0.3202763E+00	0.0	0.0
FSUMTZ LBS	0.6384851E+02	0.2094209E+00	0.0	0.0
FSUMRX LBS	0.3228963E+02	0.3033599E-01	-0.1739658E-08	0.0
FSUMRY LBS	0.1367363E+00	0.2759612E+00	-0.9368563E-01	0.2389756E+00
FSUMRZ LBS	0.4914001E+01	0.2982539E+00	-0.3410689E+02	0.2315869E+00
TSUMAX FT LBS	0.1221591E+02	0.3242620E+00	-0.2594593E-09	0.0
TSUMAY FT LBS	0.0	0.0	-0.3034125E+04	0.2315869E+00
TSUMAZ FT LBS	0.5966980E+01	0.2315869E+00	-0.4646912E+00	0.5822357E-01
TSUMTX FT LBS	0.1239796E+02	0.3202763E+00	-0.9289616E-01	0.1946436E+00
TSUMTY FT LBS	0.0	0.0	-0.1935094E+04	0.2094209E+00
TSUMTZ FT LBS	0.4180546E+01	0.2094209E+00	-0.1566190E+01	0.3202763E+00
TSUMRX FT LBS	0.2223482E+00	0.3129805E+00	-0.1754160E+00	0.2315869E+00
TSUMRY FT LBS	0.1367798E+02	0.2168096E+00	-0.1119849E+02	0.2685303E+00
TSUMRZ FT LBS	0.3202000E+00	0.3129805E+00	-0.1520557E+00	0.1433451E+00
FORCE ATTEN 1 LBS	0.6818863E+01	0.3033599E-01	-0.6893835E+01	0.2168096E+00
STROKE ATTEN 1 FT	0.1568974E-03	0.3033599E-01	-0.1115505E-03	0.2168096E+00
VELOCITY ATTEN 1 FT/SEC	0.8215103E-02	0.2241983E+00	-0.7670127E-02	0.2463643E+00
FORCE ATTEN 2 LBS	0.3528505E+02	0.3242620E+00	-0.6070695E+01	0.5822357E-01
STROKE ATTEN 2 FT	0.1366744E-01	0.3242620E+00	-0.9823123E-04	0.5822357E-01
VELOCITY ATTEN 2 FT/SEC	0.1192064E+00	0.2759612F+00	-0.9522609E-02	0.4492798E-01
FORCE ATTEN 3 LBS	0.1885298E+02	0.2241983E+00	-0.1848469E+01	0.3056847E+00
STROKE ATTEN 3 FT	0.4323847E-03	0.2241983E+00	-0.2990279E-04	0.3056847E+00
VELOCITY ATTEN 3 FT/SEC	0.1128248E-01	0.1433451E+00	-0.1518557E-01	0.2537529E+00

FORCE ATTEN 4 LBS	0.1866968E+02	0.2241983E+00	-0.2172102E+01	0.3056847E+00
STROKE ATTEN 4 FT	0.4281807E-03	0.2241983E+00	-0.3513998E-04	0.3056847E+00
VELOCITY ATTEN 4 FT/SEC	0.1114860E-01	0.1433451E+00	-0.1528569E-01	0.2537529E+00
FORCE ATTEN 5 LBS	0.3528545E+02	0.3242620E+00	-0.6010097E+01	0.5822357E-01
STROKE ATTEN 5 FT	0.1369384E-01	0.3242620E+00	-0.9725061E-04	0.5822357E-01
VELOCITY ATTEN 5 FT/SEC	0.1194025E+00	0.2759612E+00	-0.9430315E-02	0.4492798E-01
FORCE ATTEN 6 LBS	0.6856735E+01	0.3033599E-01	-0.6756788E+01	0.2168096E+00
STROKE ATTEN 6 FT	0.1576476E-03	0.3033599E-01	-0.1093328E-03	0.2168096E+00
VELOCITY ATTEN 6 FT/SEC	0.8140113E-02	0.2241983E+00	-0.7464390E-02	0.2463643E+00
RWTTA X Y Z FT	0.1582978E+01	0.0	0.1577365E+01	0.3242620E+00
	-0.5960464E-07	0.0	-0.1442432E-04	0.3242620E+00
	0.2593994E-03	0.5822357E-01	-0.1690674E-01	0.3242620E+00
AWRTA X Y Z DEG	0.1873120E-03	0.3242620E+00	-0.4981849E-05	0.8220649E-01
	0.2910683E-01	0.3242620E+00	-0.4292771E-02	0.1579114E+00
	0.2212597E-04	0.1433451E+00	-0.2927349E-03	0.3129805E+00
VWRTA X Y Z FT/SEC	0.8210421E-02	0.4492798E-01	-0.4941684E-01	0.2833921E+00
	0.3766998E-04	0.1116806E+00	-0.1615873E-03	0.2537529E+00
	0.6716490E-02	0.3033599E-01	-0.1483641E+00	0.2759612E+00
OWRTA X Y Z DEG/SEC	0.3622686E-02	0.2168096E+00	-0.1238710E-02	0.2463643E+00
	0.5700004E+00	0.2610994E+00	-0.2537137E+00	0.1433451E+00
	0.4371025E-02	0.3242620E+00	-0.5631998E-02	0.3056847E+00
RWRTT X Y Z FT	-0.6873970E+00	0.0	-0.6975880E+00	0.1506282E+00
	0.8738041E-04	0.3242620E+00	0.2384186E-06	0.0
	0.6220245E+00	0.2094209E+00	0.6011200E+00	0.0
AWRTT X Y Z DEG	0.2099082E-03	0.3242620E+00	-0.3614566E-05	0.8220649E-01
	0.4999991E+01	0.0	0.4786135E+01	0.3242620E+00
	0.2591594E-03	0.3242620E+00	-0.2691181E-05	0.3033599E-01
VWRTT X Y Z FT/SEC	0.1205593E+00	0.3242620E+00	-0.1403154E+00	0.0
	0.5617759E-03	0.2982539E+00	0.4733684E-07	0.0
	0.1507650E+00	0.0	-0.1031010E+00	0.2833921E+00
OWRTT X Y Z DEG/SEC	0.3596339E-02	0.2168096E+00	-0.1099868E-02	0.2463643E+00
	-0.2623852E-01	0.2610994E+00	-0.1032024E+01	0.1433451E+00
	0.7448800E-02	0.3242620E+00	-0.2522275E-02	0.3056847E+00

FORCE -- TARGET FINGER-RING 4-6	0.0	0.0	0.0	0.0
	0.5110207E+02	0.2094209E+00	0.0	0.0
	0.5158023E+02	0.2094209E+00	0.0	0.0
ACTIVE INTERFACE TORQUES,FT LBS	0.1751614E+00	0.2315869E+00	-0.2225294E+00	0.3129805E+00
	0.3403076E+01	0.9299755E-01	-0.1378320E+03	0.2168096E+00
	0.7061529E+00	0.2908230E+00	-0.8462715E-01	0.8220649E-01
TARGET INTERFACE TORQUES, FT LBS	0.0	0.0	-0.3165951E+00	0.3202763E+00
	0.2191206E+03	0.2094209E+00	0.0	0.0
	0.0	0.0	-0.1059144E+01	0.3202763E+00
TARGET FINGER INTERFERENCE DISTANCE	0.6471348E+00	0.1651945E+00	0.6339750E+00	0.0
	0.4086068E+00	0.1579114E+00	0.3986807E+00	0.0
	-0.2319756E+00	0.9299755E-01	-0.2345877E+00	0.2094209E+00
TMOTOR FT LBS	0.0	0.0	0.0	0.0

GRAPHING TIME = 0.71899996E+01 SECONDS KNT= 35

```
ASP JOB NO. = 0326    ID(DAY TIME) = (004 16.01.12)    DATE = 74.004

77TD1ND184 JOB 'MOUNT G   81  6964074138743133  201  004  3900605   ',     |

ELAPSED TIME ON MAIN = 1651     = 012.85, START TIME = 20.07.34

DDNAME = SYSMSG   PRINTED ON RM001PR1, LINES = 000164
DDNAME = SYSUDUMP PRINTED ON RM031    , LINES = 000000
DDNAME = SYSPRINT PRINTED ON RM001PR1, LINES = 001297
DDNAME = FT06F001 PRINTED ON RM001PR1, LINES = 000607
LINES OUTPUT FOR THIS JOB = 002068

NO CARD OUTPUT FOR THIS JOB.
```

PLOTTED OUTPUT DATA NOMENCLATURE

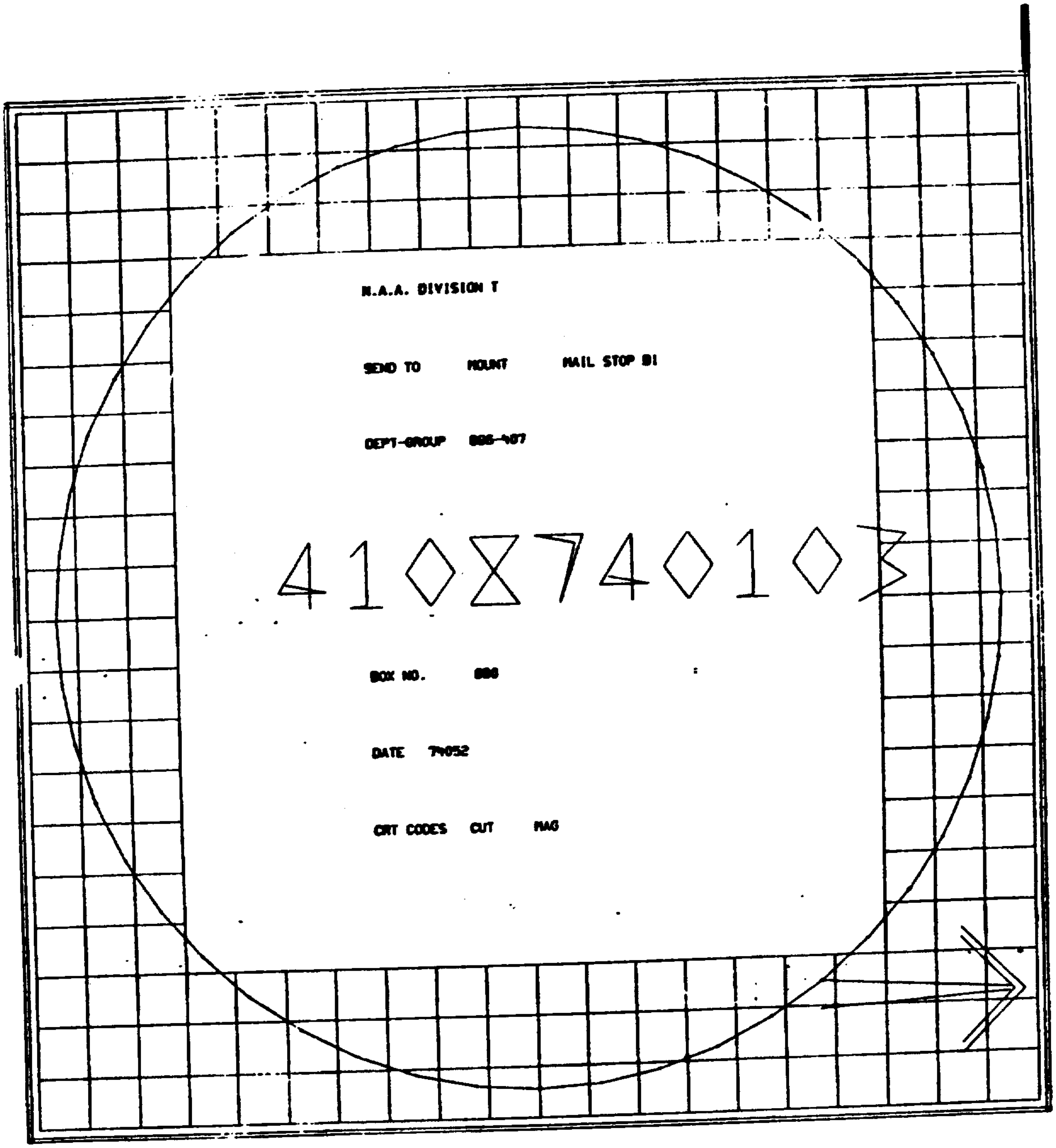
Name	Definition	Page
XAD YAD ZAD	Inertial velocity, active vehicle C.G, in the X, Y, and Z directions of the inertial frame	6
XTD YTD ZTD	Inertial velocity, target vehicle C.G., in the X, Y, and Z directions of the inertial frame	7
XRD YRD ZRD	Inertial velocity, guide ring C.G., in the X, Y, and Z directions of the inertial frame	8
XA YA ZA	Position of the active vehicle C.G. respect to the inertial frame located initially at the target vehicle C.G.	9
XT YT ZT	Position of the target vehicle C.G., with respect to the inertial frame located initially at the target vehicle C.G.	10
XR YR ZR	Position of the guide ring C.G., with respect to the inertial frame located initially at the target vehicle C.G.	11
OMEGXA OMEGYA OMEGZA	Angular rate of the active vehicle about its X, Y, and Z body axes	12
OMEGXT OMEGYT OMEGZT	Angular rate of the target vehicle about its X, Y, and Z body axes	13
OMEGXR OMEGYR OMEGZR	Angular rate of the guide ring about its X, Y, and Z body axes	14
PHA THA PSA	Euler angles of the active vehicle about the X, Y, and Z axes respectively, i.e., phi, theta, and psi	15
PHT THT PST	Euler angles of the target vehicle about the X, Y, and Z axes respectively	16
PHR THR PSR	Euler angles of the guide ring about the X, Y, and Z axes respectively	17
FSUMAX FSUMAY FSUMAZ	Total force at the active vehicle C.G in its X, Y, and Z body axes; includes RCS forces	18

Name	Definition	Page
FSUMTX FSUMTY FSUMTZ	Total forces at the target vehicle C.G. in its X, Y, and Z body axes; includes RCS forces	19
FSUMRX FSUMRY FSUMRZ	Total forces at the guide ring C.G. in its X, Y, and Z body axes	20
TSUMAX TSUMAY TSUMAZ	Total moments about the active vehicle C.G. in its X, Y, and Z body axes, includes RCS moments	21
TSUMTX TSUMTY TSUMTZ	Total moments about the target vehicle C.G. in its X, Y, and Z body axes, includes RCS moments	22
TSUMRX TSUMRY TSUMRZ	Total moments about the guide ring C.G. in its X, Y, and Z body axes	23
RCS FORCE & MOMENTS, ACTIVE VEHICLE	Time durations of active vehicle RCS forces and moments in its X, Y, and Z body axes	24
RCS FORCE & MOMENTS TARGET VEHICLE	Time duration of target vehicle RCS forces and moments in its X, Y, and Z body axes	25
FORCE ATTN 1 STROKE ATTN 1 VELOCITY ATTN 1	Axial force, stroke, and stroke rate of attenuator (shock absorber) No. 1	26
SAME FOR ATTENUATORS NO. 2 THROUGH NO. 6		27 - 31
RWTTA X Y Z	Guide ring position with respect to the active vehicle docking interface structural base center line	32
AWRTA X Y Z	Guide ring relative angle about the active vehicle interface base X, Y, and Z axes	33
VWRTA X Y Z	Guide ring relative velocity with respect to the active vehicle interface X, Y, and Z axes	34
OWRTA X Y Z	Guide ring relative angular rate about the active vehicle interface base X, Y, and Z axes	35

Name	Definition	Page
RWRTT	Guide ring position with respect to the target vehicle docking interface structural base center line	36
AWRTT	Guide ring relative angle about the target vehicle interface base X, Y, and Z axes	37
VWRTT	Guide ring relative velocity with respect to the target vehicle interface X, Y, and Z axes	38
OWRTT	Guide ring relative angular rate about the target vehicle interface base X, Y, and Z axes	39
FORCE BETWEEN FINGERS 1/3	Normal force on the active guide edges 1 through 3	40
SAME FOR GUIDE EDGES 4 THROUGH 6		41
FORCE TARGET FINGERS/ RING 1/3	Normal force between target vehicle guide edges 1 through 3 on active vehicle guide ring	42
SAME FOR GUIDE EDGES 4 THROUGH 6		43
FORCE RING FINGER/TARGET 1/3	Normal force between active vehicle guide edges 1 through 3 on target vehicle guide ring	44
SAME FOR GUIDE EDGES 4 THROUGH 6		45
ACTIVE INTERFACE TORQUES	Docking moments about the active vehicle docking interface structural base X, Y, and Z axes RCS moments not included	46
TARGET INTERFACE TORQUES	Docking moments about the target vehicle docking interface structural base X, Y, and Z axes RCS moments not included	47
TARGET FINGER INTERFERENCE DISTANCE	Normal distance between target vehicle guides and some reference point on the active vehicle input by C(23) and C(24)	48

Name	Definition	Page
TMOTOR	Retract motor torque used to draw capture-latched vehicles together	49
FCABL1 FCABL2 FCABL3	Force in retract cables Nos. 1, 2, and 3 (not shown in example)	50

Space Division
Rockwell International



**** INITIAL CONDITIONS ****

CASE NO.28,ORBITER DOCKING, ASTP SYSTEM

ACTIVE VEHICLE

OMEGXA	-0.38019770E-10	PHA	0.49999981E+01	OMEGYA	0.29885811E+00	THA	-0.99999990E+01
OMEGZA	-0.26146747E-01	PSA	0.10838709E-05	XAD	0.50000000E+00	XA	-0.17545181E+02
YAD	0.62795721E-07	YA	0.31287985E+01	ZAD	0.19999999E+00	ZA	-0.75790192E+02
XMA	0.73700000E+04	XXIA	0.68850000E+07	YYIA	0.67380000E+07	ZZIA	0.85600000E+06
XYIA	0.99999993E-03	XZIA	-0.25199997E+00	YZIA	0.20000001E-02	OFFJA	0.83000004E-01
OFFKA	0.37800003E+02	RA	0.94700003E+01				

TARGET VEHICLE

OMEGXT	0.0	PHT	0.0	OMEGYT	0.0	THT	0.0
OMEGZT	0.0	PST	0.0	XMT	0.73700000E+04	XXIT	0.68850000E+07
YYIT	0.67380000E+07	ZZIT	0.85600000E+06	XYIT	0.99999993E-03	XZIT	-0.25199997E+00
YZIT	0.20000001E-02	OFFJT	-0.83000004E-01	OFFKT	-0.37800003E+02	RT	-0.94700003E+01

C-ARRAY/ ATTENUATOR DATA

NO ATTENUATORS = 6

0.800003E-70	0.239000E+01	0.274000E+01	-0.300000E+02	0.100000E+01	0.333000E-02	0.300000E+02	-0.850000E+01
0.870000E+05	0.176700E+01	0.700000E-03	0.0	0.0	0.0	0.0	0.125000E+02
0.0	0.391000E+00	0.900000E+02	0.750000E+00	0.0	0.100000E+01	0.0	0.213500E+01
0.120000E+00	0.122787E+01	0.449500E-01	0.883000E-04	0.182718E+01	0.198350E+00	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.900000E+02
-0.600000E+01	0.900000E+02	0.200000E+00	0.0	0.300000E+00	0.900000E+02	0.800001E-70	0.0
0.0	0.0						

4108740103
022174 0002

D - ARRAY

0.823498E+00	-0.113833E+00	-0.862733E+00	0.0	0.0	0.750000E+01	0.750000E+01	0.750000E+01
0.0	0.0	0.0	0.0	0.0	-0.723700E+75	0.0	0.190000E+00
-0.111700E+00	0.234000E+06	0.100000E+04	-0.350000E+00	0.254000E+01	0.254000E+01	0.100000E+01	0.600000E+00
0.850000E+04	0.273000E-03	0.0	0.0	0.0	0.0		

PROGRAM COMMANDS

IPHASE	1	STOP	0.10000000E+02	DELPP	0.0	CASE	0.0
IGRAPH	1	DELP	0.10000000E+01	DESLC	0.99999964E-01	JN	0
NPLOT	15						

4100740103
022174 0003

CASE NO.28,ORBITER DOCKING, ASTP SYSTEM

INTEGRATION DATA

THESM	0.29999999E-03	N	50	A3	0.0	A5	0.10000002E-01
KAI	0	A2	0.99999997E-05	A4	0.29999999E-03	A7	0.19999999E+00
A2A	0.50000000E-03	A4A	0.10000002E-01				

REACTION CONTROL SYSTEM

ACTIVE CONTROL SYSTEM

THCOMA	-0.60000000E+01	PHCOMA	0.50000000E+01	PSCOMA	0.10830718E-05	ARXA	0.89999999E+00
ARYA	0.89999999E+00	ARZA	0.89999999E+00	ADPHA	0.10000000E+01	ADTHA	0.10000000E+01
ADPSA	0.10000000E+01	RDA	0.0	FRA	0.90000000E+03	BRA	0.22999999E-01
DBANXA	0.43000001E+00	DBANYA	0.43000001E+00	DBANZA	0.43000001E+00	THA	0.10000000E+01
REACTA	0.50000000E+00	BANXA	0.89999999E+00	BANYA	0.89999999E+00	BANZA	0.89999999E+00
IR	0	RMAXA	0.10000000E+02	YMAXA	0.10000000E+02	PMAXA	0.10000000E+02
REACTIA	0.10000000E+04						

TARGET CONTROL SYSTEM

RDTY	0.0	RDTZ	0.0	FIRET	0.90000000E+03	BRT	0.22999999E-01
ARXT	0.89999999E+00	ARYT	0.89999999E+00	ARZT	0.89999999E+00	ADPHT	0.10000000E+01
ADTHT	0.10000000E+01	ADPST	0.10000000E+01	DBANXT	0.43000001E+00	DBANYT	0.43000001E+00
DBANZT	0.43000001E+00	THCONT	0.0	PHCONT	0.0	PSCONT	0.0
REACTT	0.40000000E+02	BANXT	0.89999999E+00	BANYT	0.89999999E+00	BANZT	0.89999999E+00
DQ1	0.0	DQ2	0.0	DQ3	0.0	THT	0.10000000E+01
RMAXT	0.10000000E+02	YMAXT	0.10000000E+02	PMAXT	0.10000000E+02	IRCS	3
IVDH	1	REACT1T	0.40000000E+03				

CASE NO.20,ORBITER DOCKING, ASTP SYSTEM

SIMPLIFIED INITIAL CONDITIONS

THANG	0.90000000E+02	THTOT	-0.80000000E+01	THVEL	0.90000000E+02	VELLAT	0.19999999E+00
OMEOR	0.0	OMEGT	0.30000001E+00	THOMEG	0.90000000E+02	VAXIAL	0.50000000E+00
XMISS	0.75000000E+00	THDRO	0.89999998E+02				

STROKE VS AREA TABLES

-0.10000000E+01	0.31400001E+00
0.0	0.31400001E+00
0.28999998E+01	0.10000002E-01
0.35000000E+01	0.34000000E-02
0.40000000E+01	0.10499999E-02
0.43000002E+01	0.10000001E-02
0.45000000E+01	0.89999998E-03
0.12000000E+02	0.80999998E-03

4108740103
022174 0005

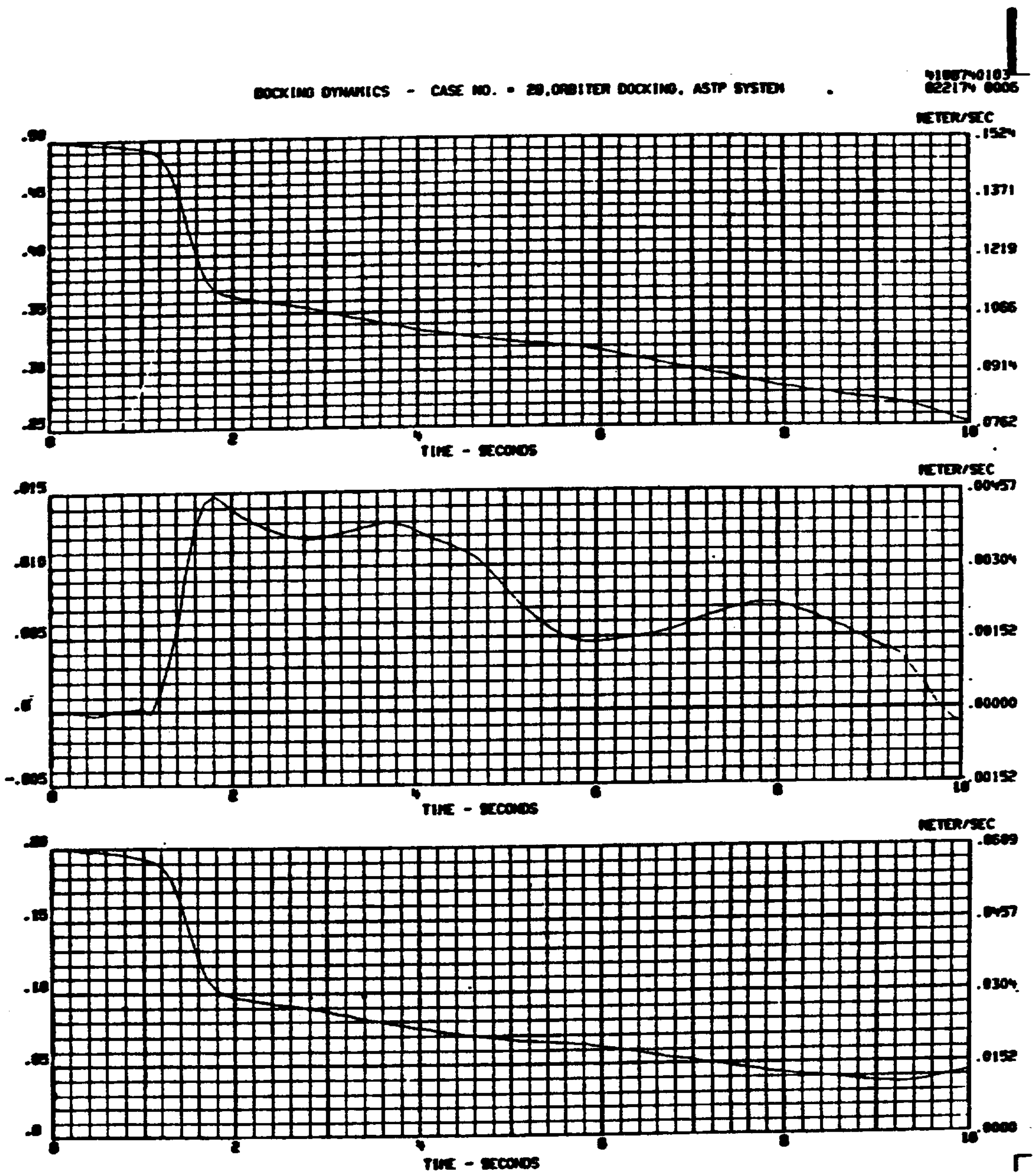
CASE NO.20,ORBITER DOCKING, ASTP SYSTEM

***** ADD - ARRAY ****

0.100000E-02	0.0	0.0	0.161400E+02	0.430000E+02	0.244000E+02	0.244000E+02	0.800002E-70
0.104720E+01	0.213200E+01	0.844000E-01	0.0	0.0	0.907570E+00	0.412000E+01	0.0
[illegible]	0.210000E+05	[illegible]	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.119000E+06	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.150300E+01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.800002E-70	0.325000E+00	0.234000E+01
0.0	0.100000E+03	0.700000E-02	0.700000E-02	0.0	0.0	0.0	0.0
0.0	0.400000E+02	0.320000E+06	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.100000E-02	0.900000E+00	0.0	0.0	0.0
0.0	0.0	0.0	0.0				

ORIGINAL PAGE IS
OF POOR QUALITY

L-2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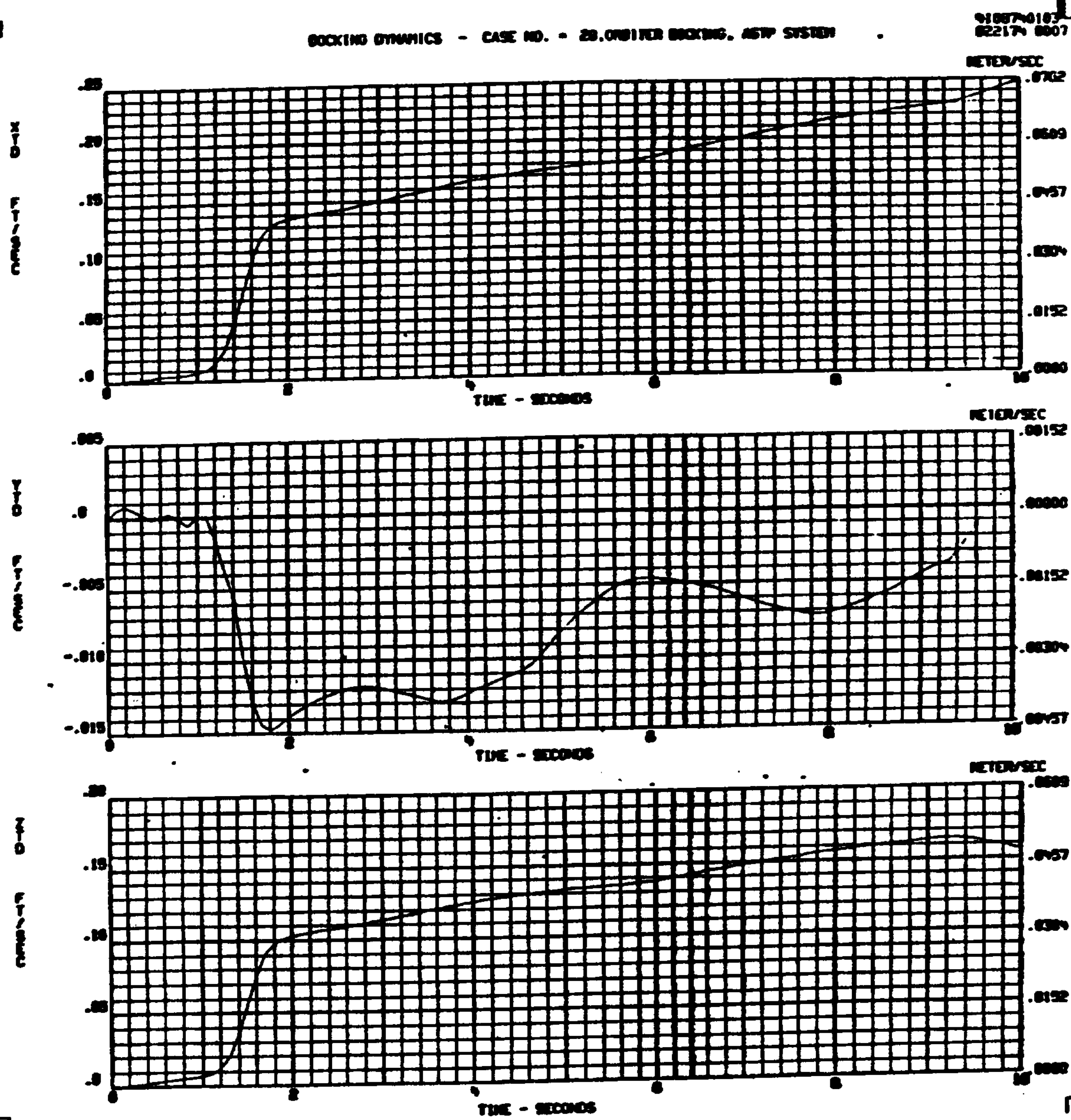
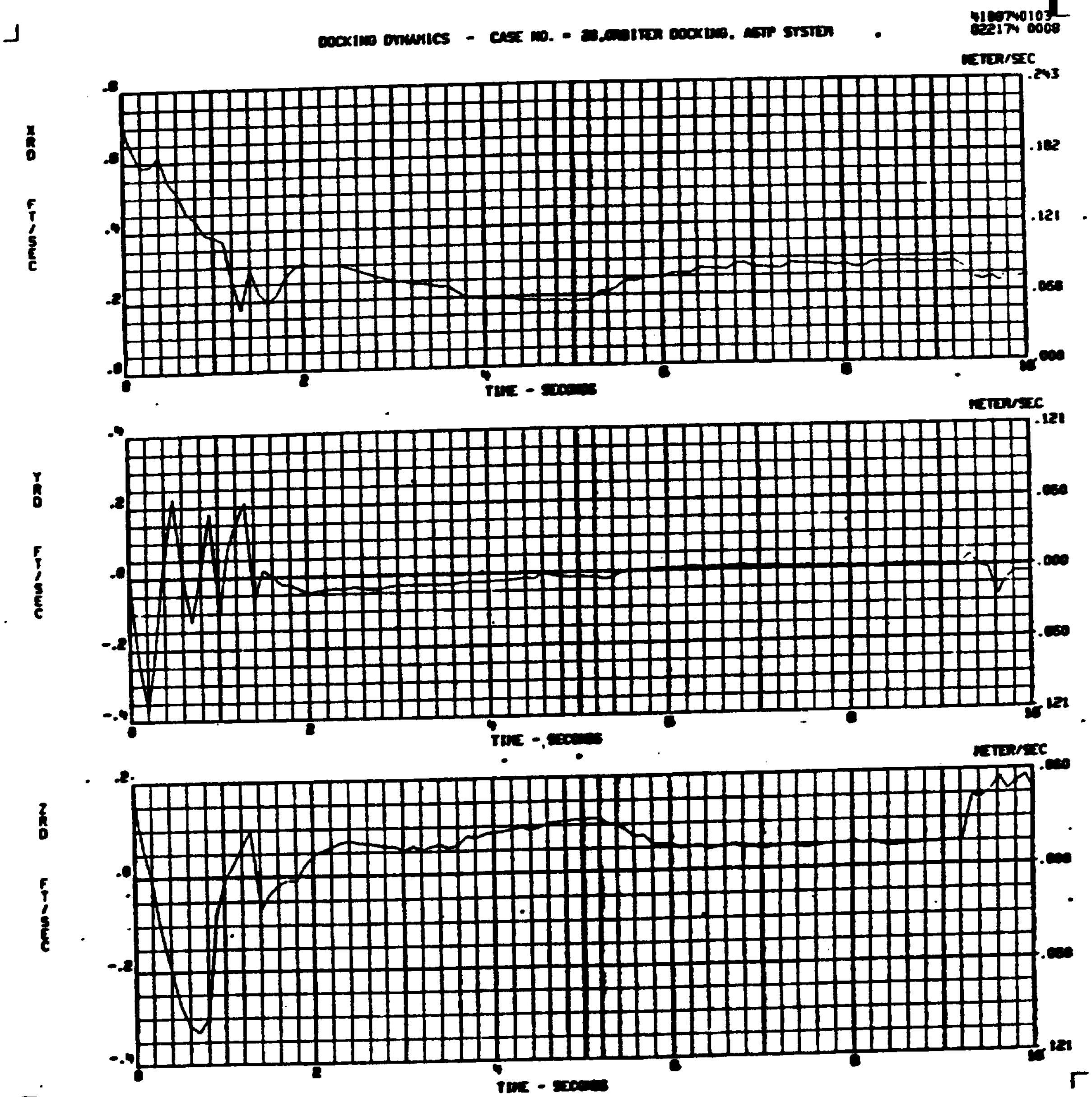
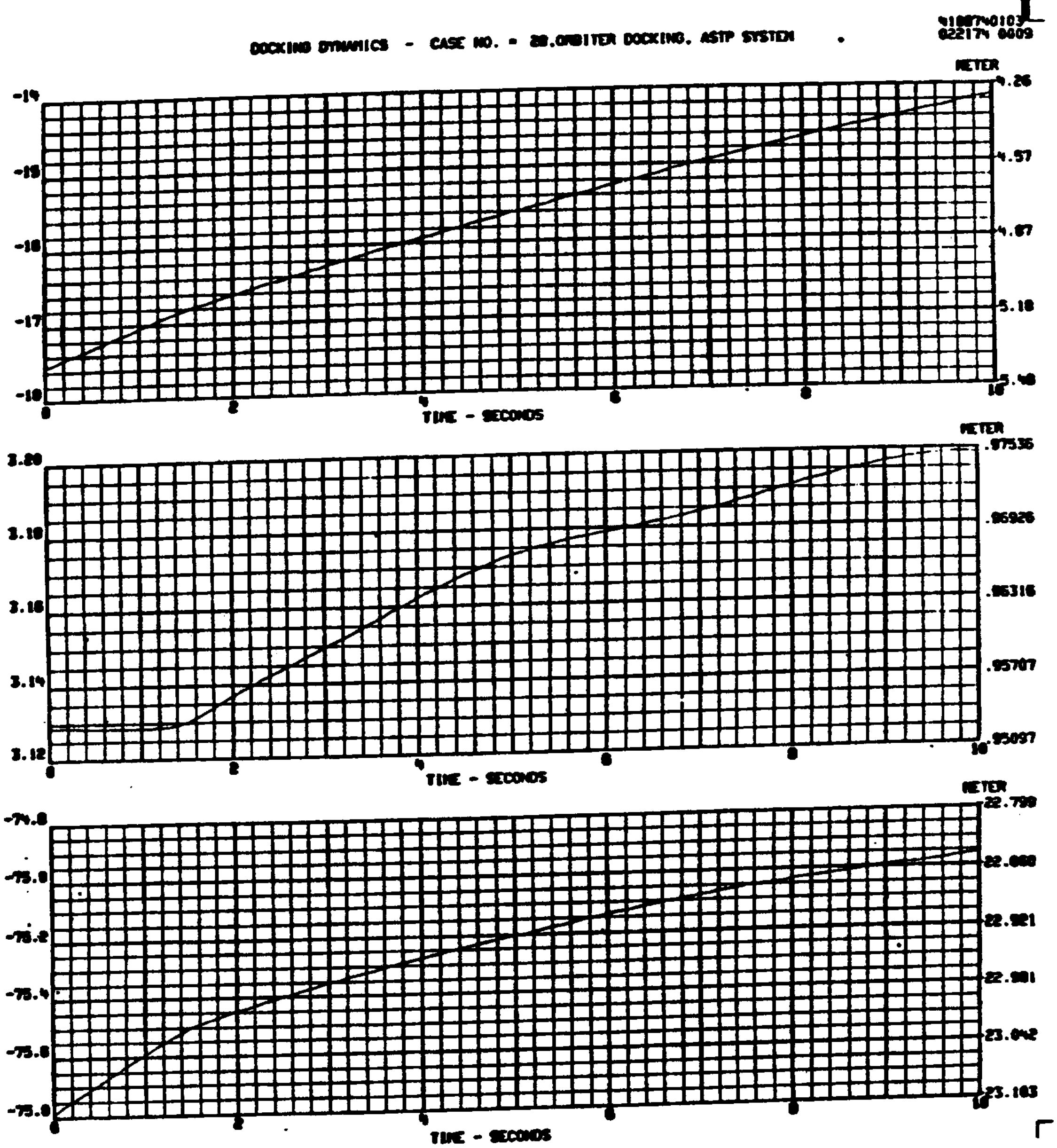
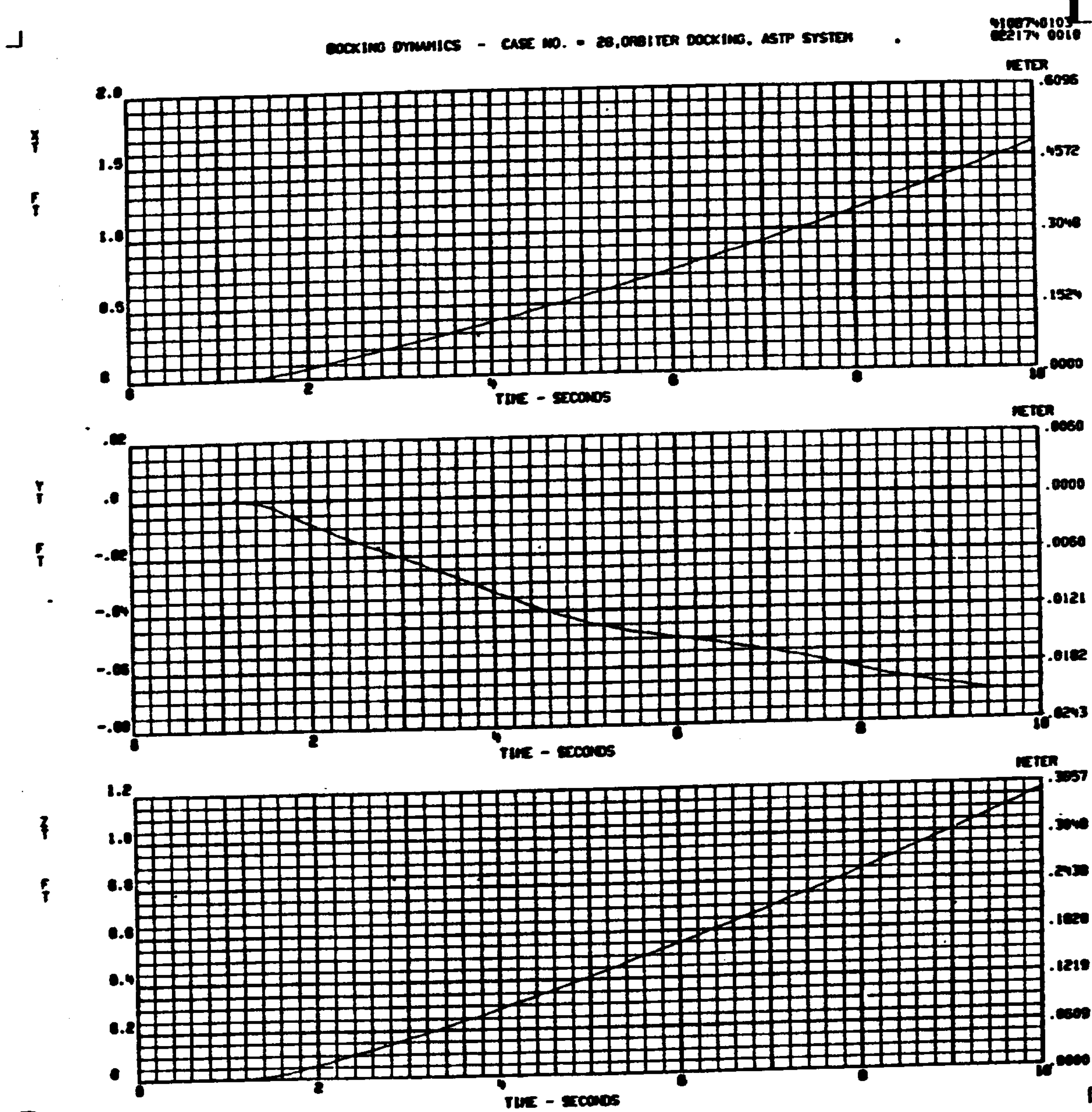
METER/SEC
.1524
.1371
.1219
.1066
.0914
.0762
TIME - SECONDS
METER/SEC
.00457
.00304
.00152
.00000
.00152
TIME - SECONDS
METER/SEC
.0609
.0457
.0304
.0152
.0000
TIME - SECONDS

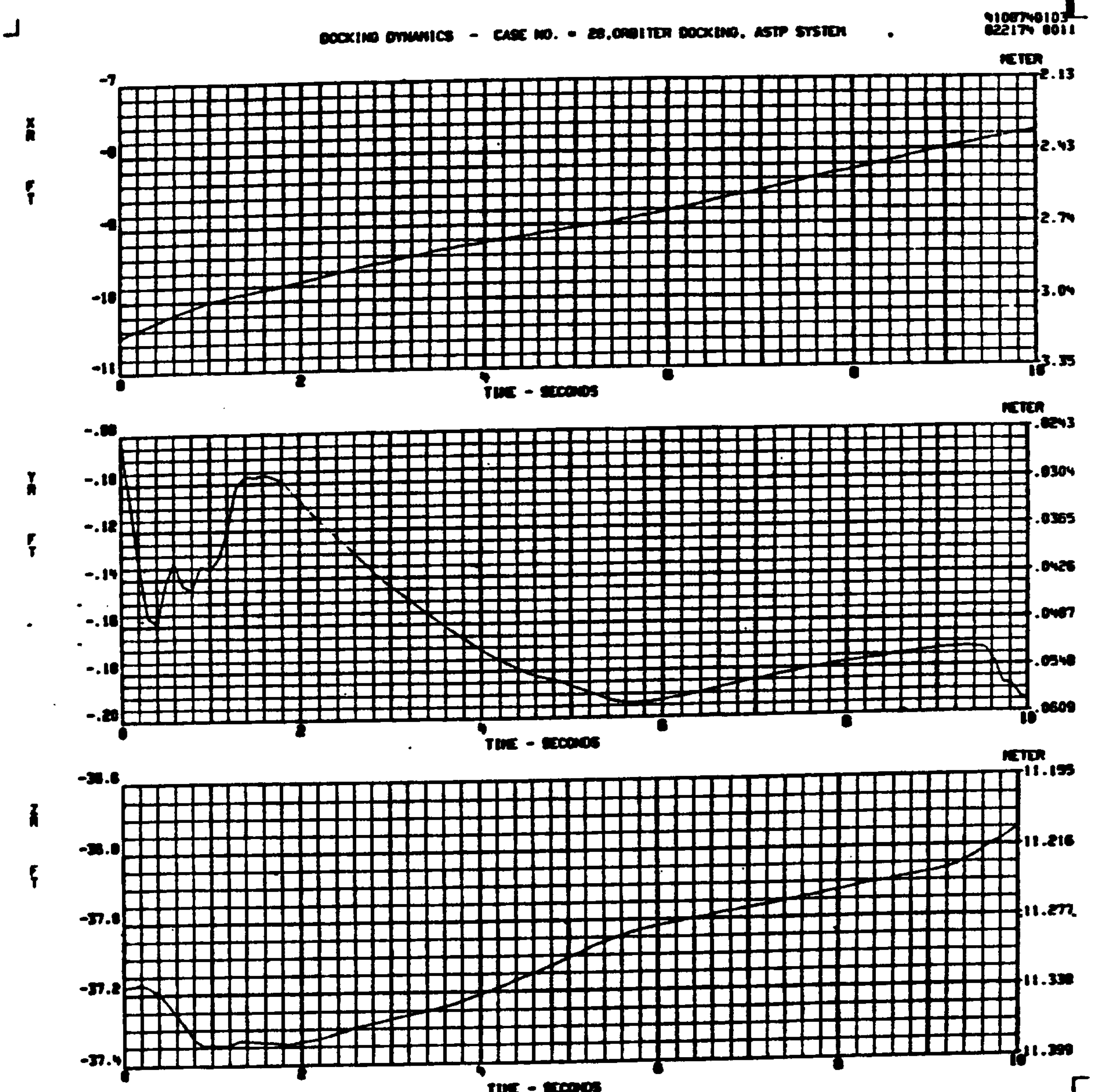

DOCKING DYNAMICS - CASE NO. - 20.ORBITER DOCKING, ASTP SYSTEM
METER/SEC
X D FT/SEC
TIME - SECONDS
METER/SEC
Y D FT/SEC
TIME - SECONDS
METER/SEC
Z D FT/SEC
TIME - SECONDS


DOCKING DYNAMICS - CASE NO. = ORBITER DOCKING, ASTP SYSTEM
METER/SEC
XRD FT/SEC
TIME - SECONDS
METER/SEC
YRD FT/SEC
TIME - SECONDS
METER/SEC
ZRD FT/SEC
TIME - SECONDS


41087401037
022174 0009
DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
X A F T
-14
-15
-16
-17
-18
METER
4.26
4.57
4.87
5.18
5.48
TIME - SECONDS
Y A F T
3.20
3.18
3.16
3.14
3.12
.97536
.96926
.96316
.95707
.95097
Z A F T
-74.8
-75.0
-75.2
-75.4
-75.6
-75.8
22.799
22.860
22.921
22.981
23.042
23.103


DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM
XT
FT
METER
TIME - SECONDS
YT
FT
METER
TIME - SECONDS
ZT
FT
METER
TIME - SECONDS

Space Division
Rockwell International



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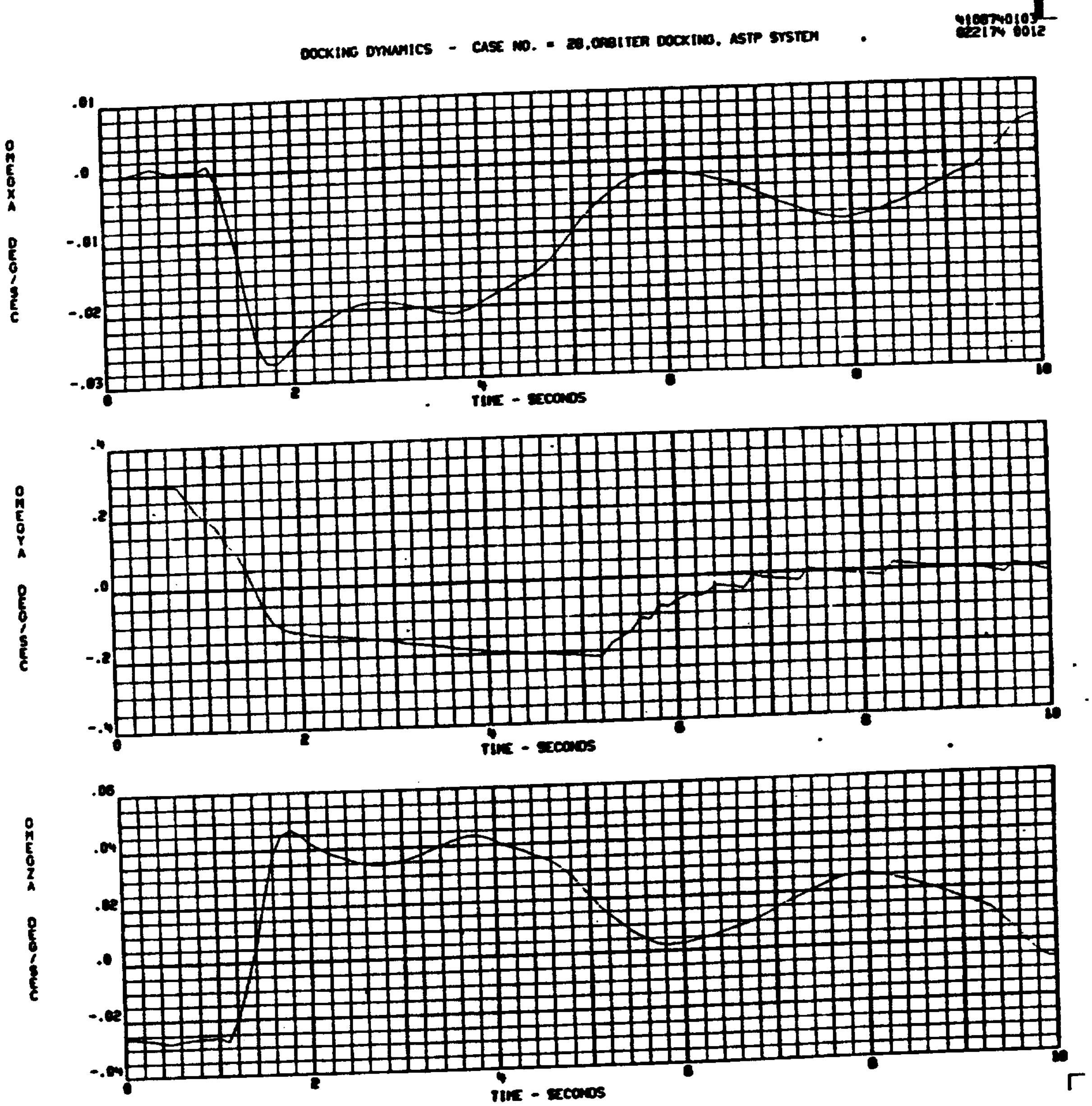
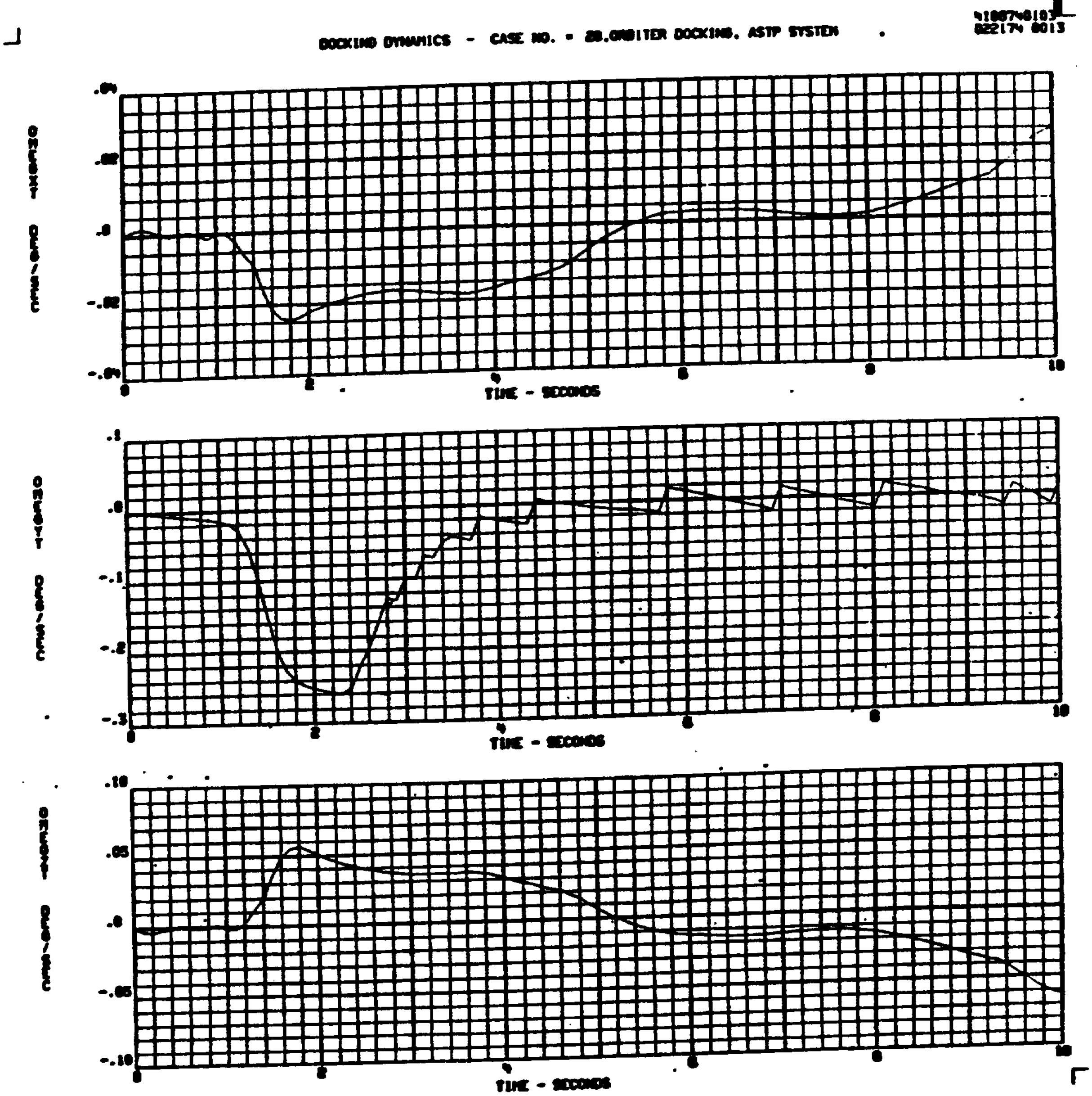
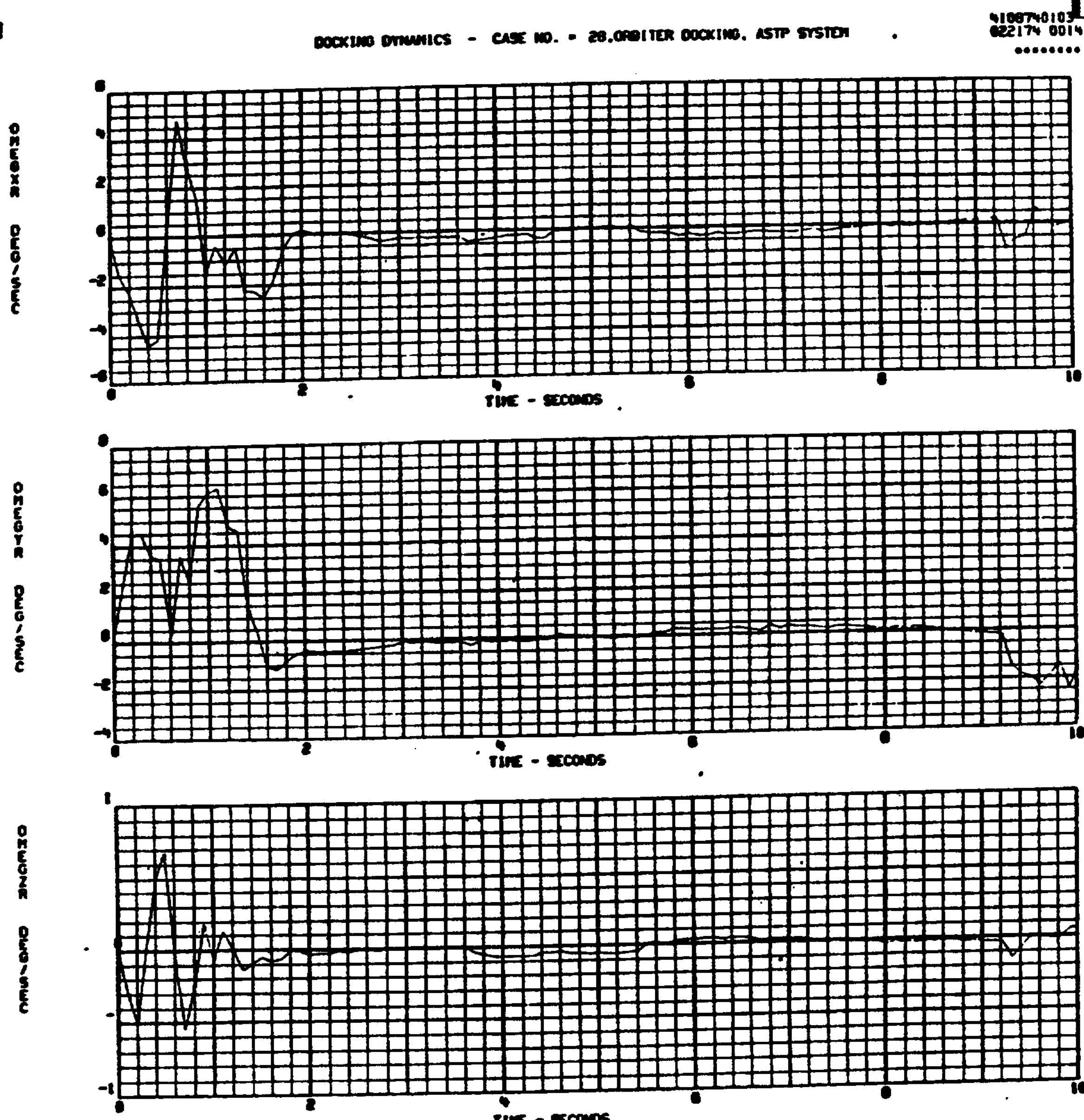
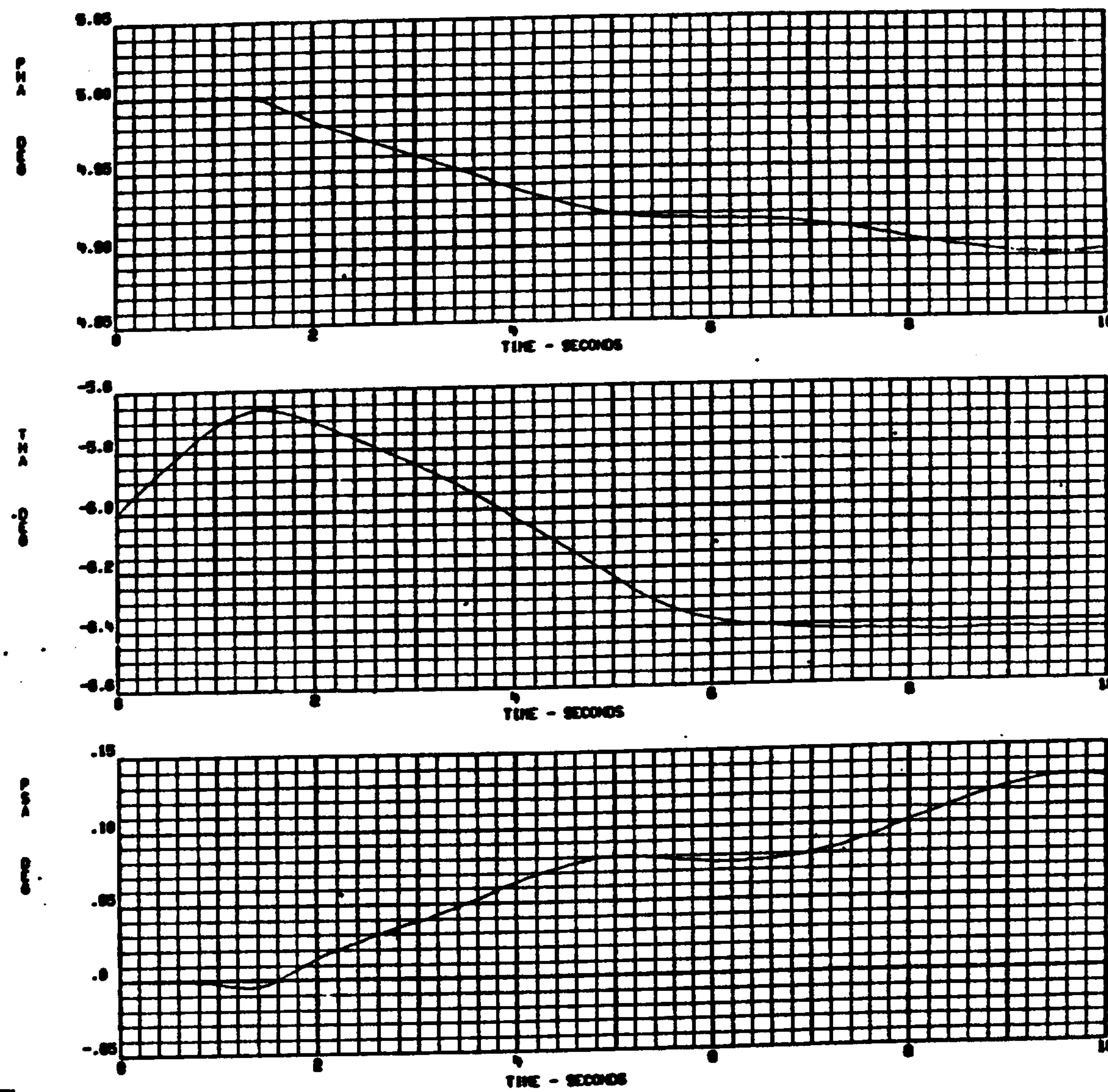



DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
OMEGXT DEG/SEC
OMEGYT DEG/SEC
OMEGZT DEG/SEC
TIME - SECONDS
TIME - SECONDS
TIME - SECONDS


DOCKING DYNAMICS - CASE NO. = 20.ORBITER DOCKING, ASTP SYSTEM
OMEGXR DEG/SEC
OMEGYR DEG/SEC
OMEGZR DEG/SEC
TIME - SECONDS
TIME - SECONDS
TIME - SECONDS

DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM

4108740103
022174 0015



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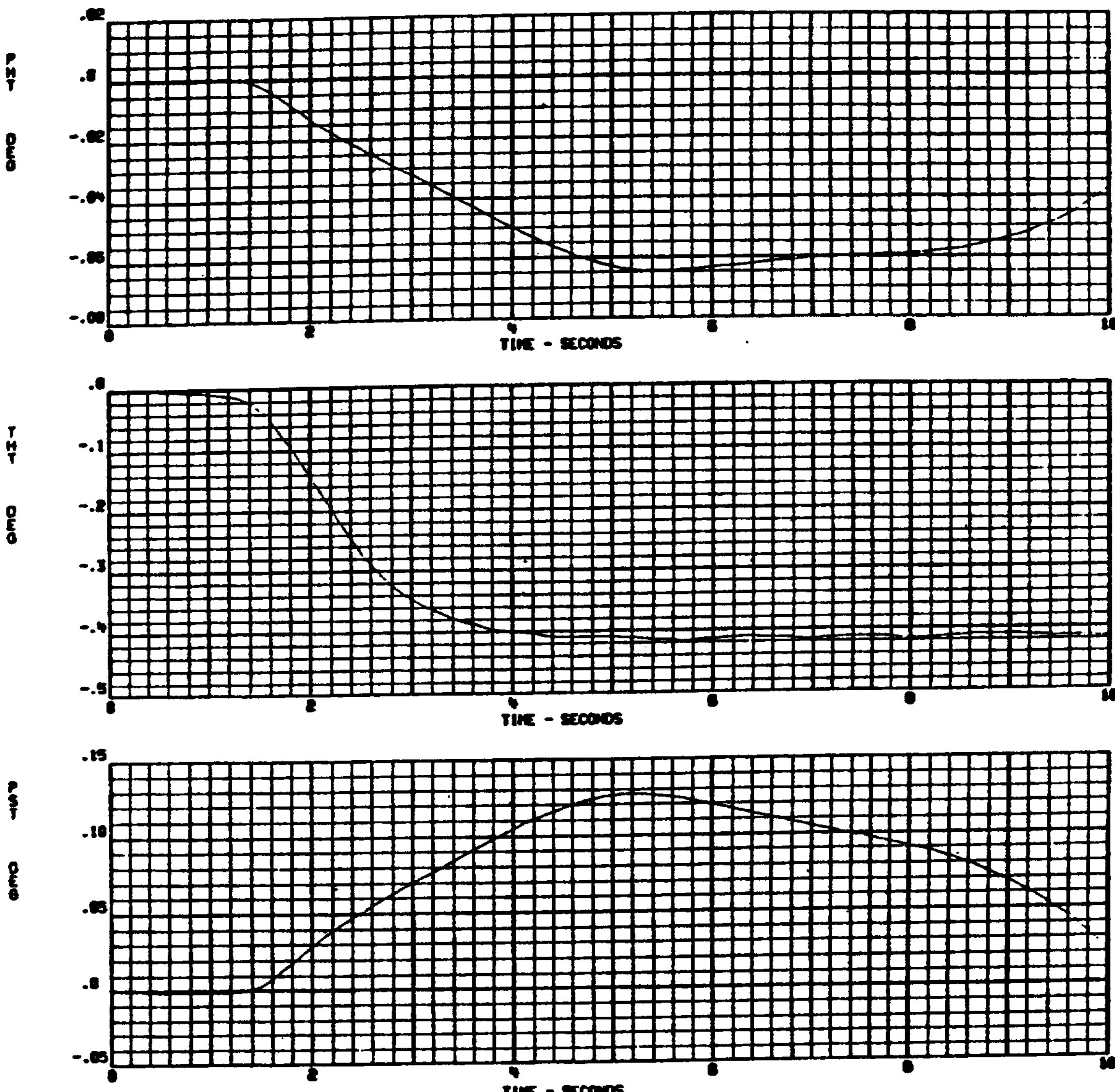
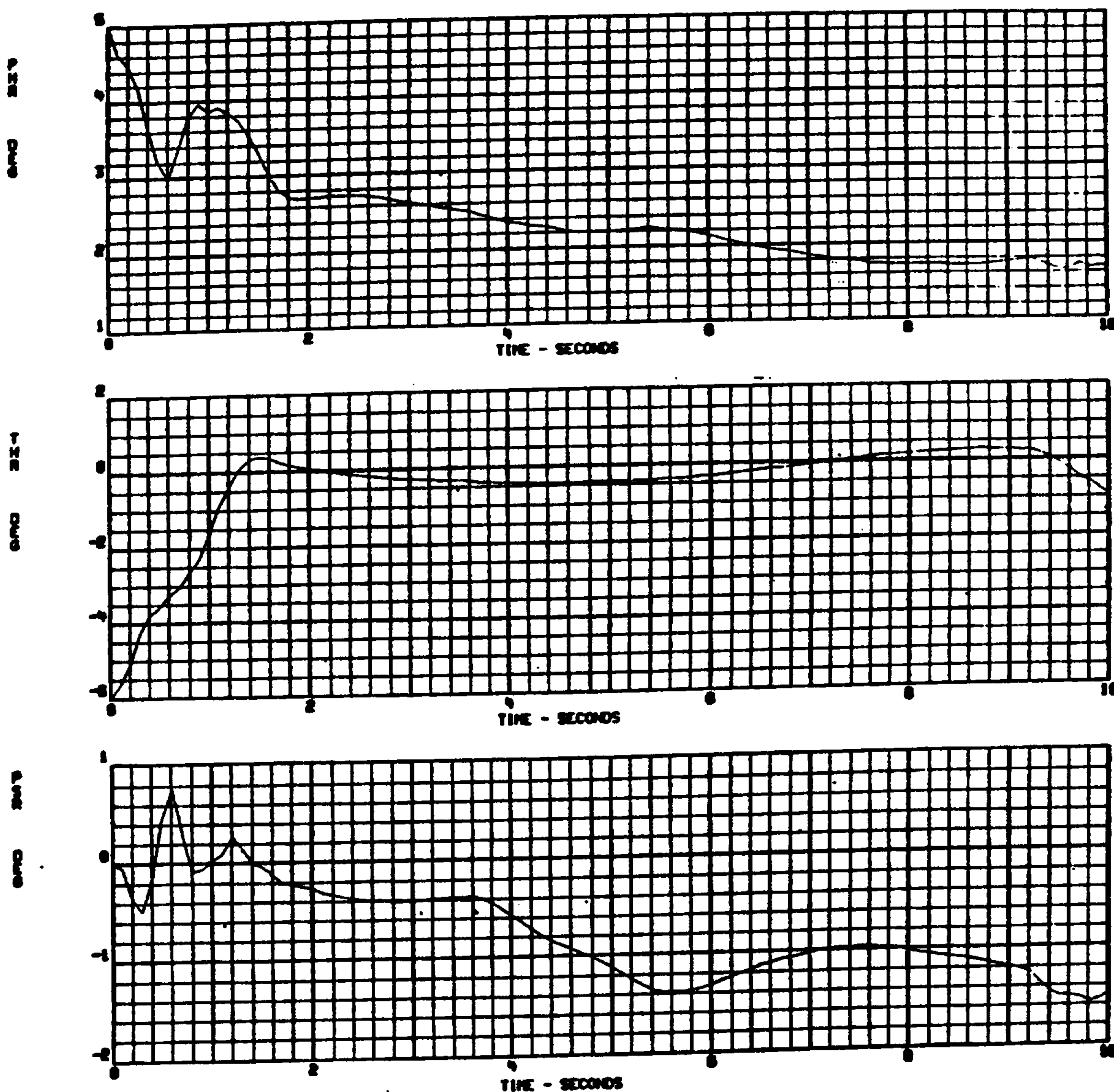
022174 0016

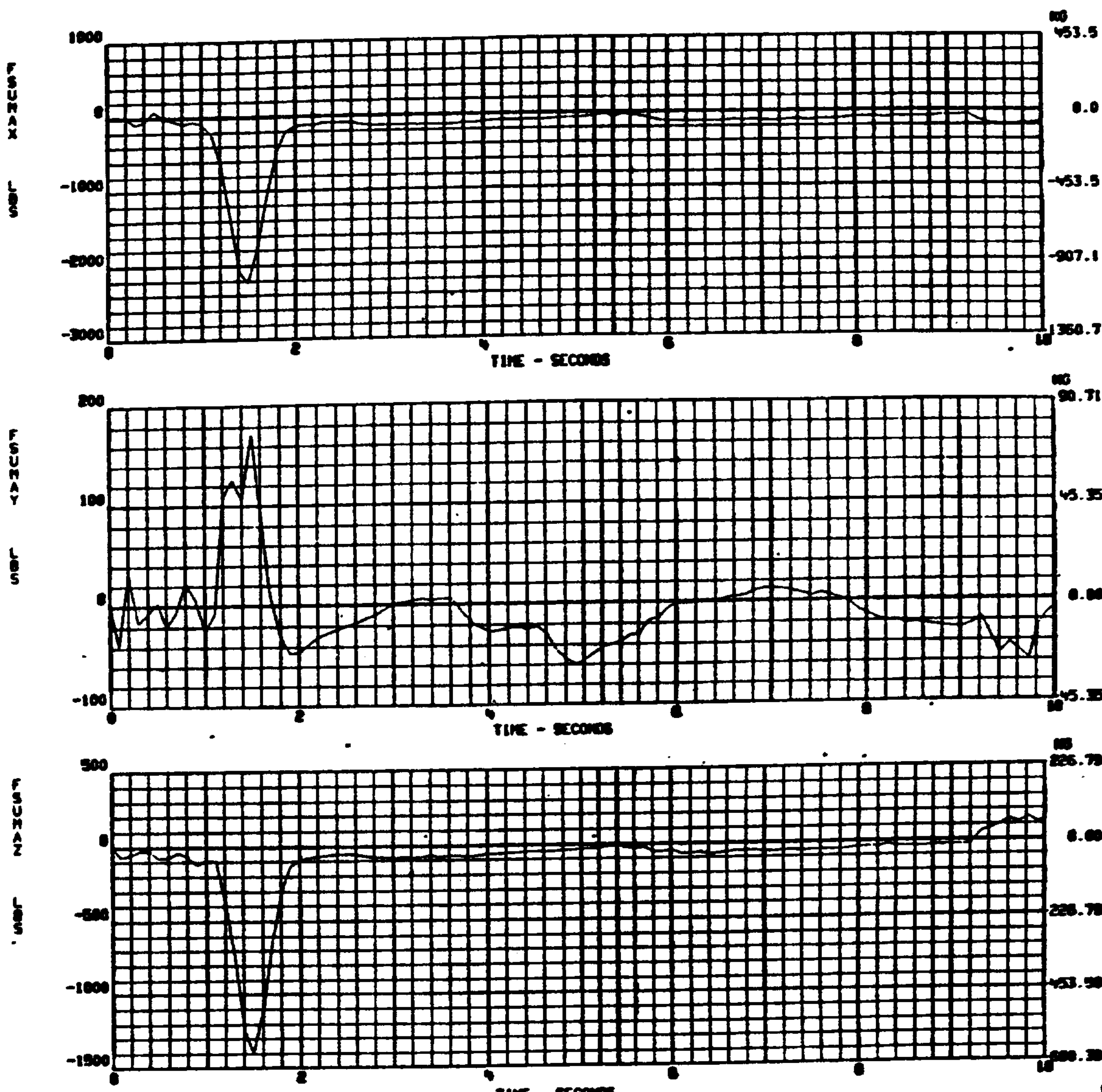


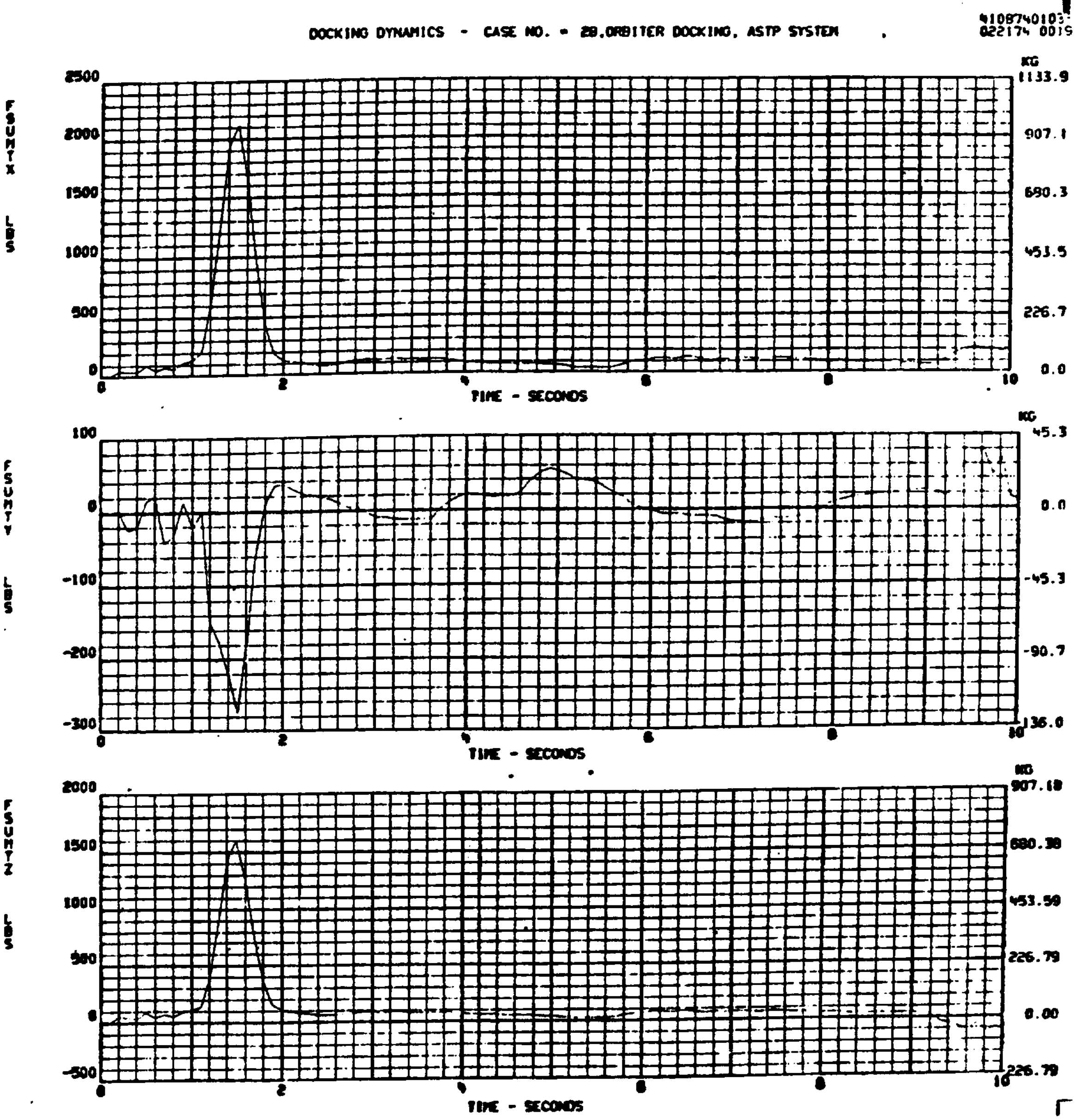
DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM

4108740103
022174 0017



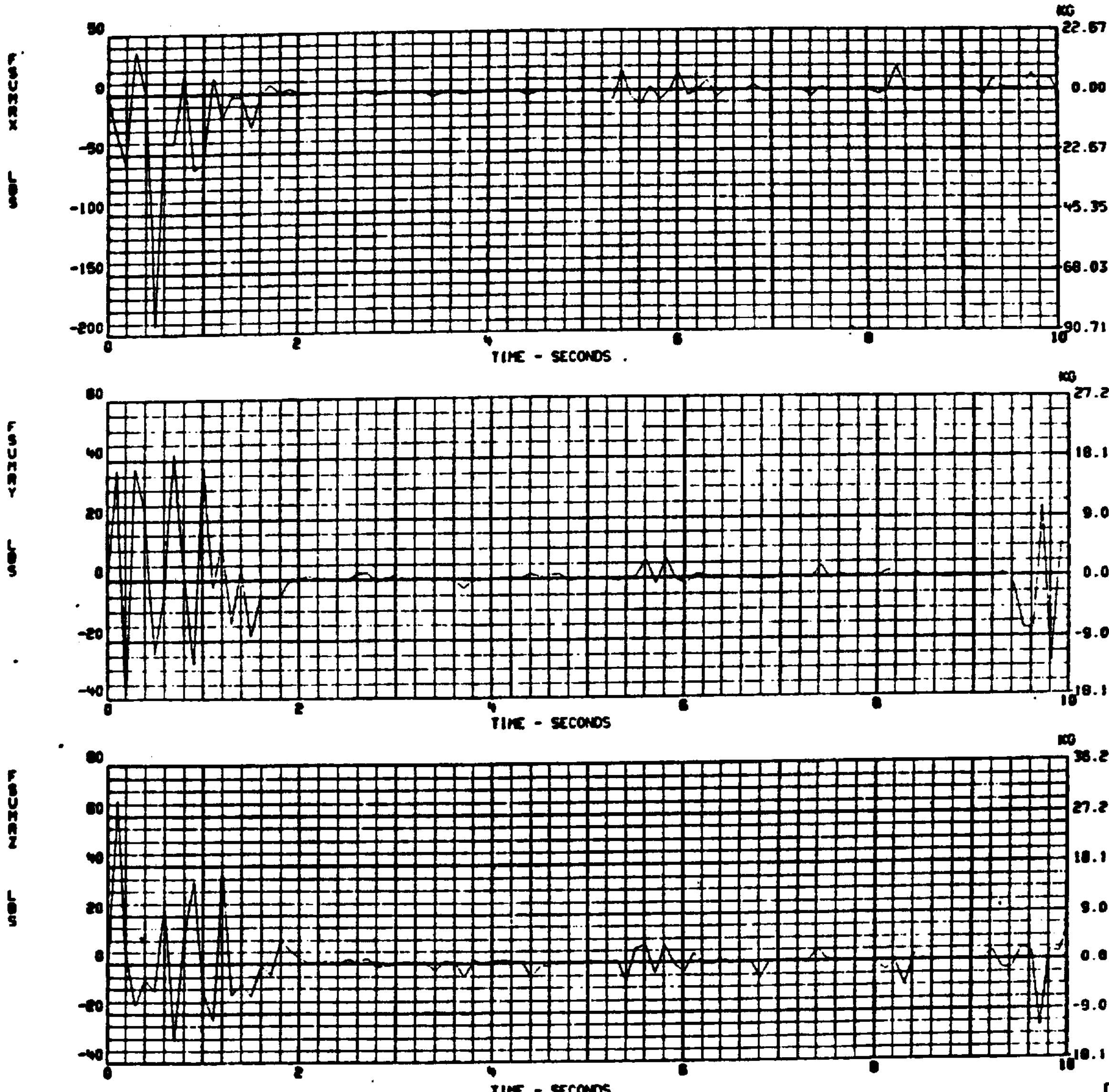
DOCKING DYNAMICS - CASE NO. = 80,ORBITER DOCKING, ASTP SYSTEM

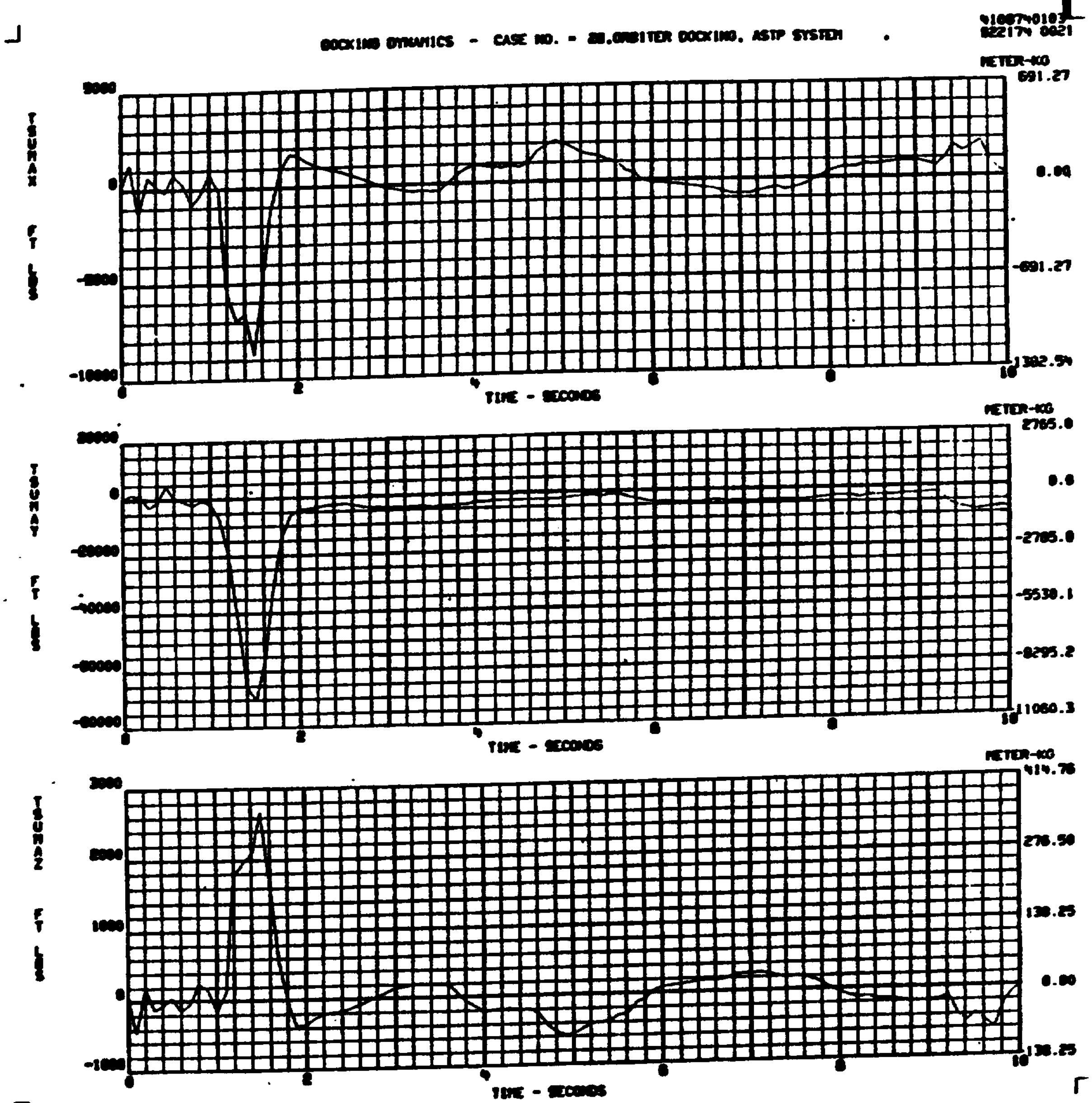


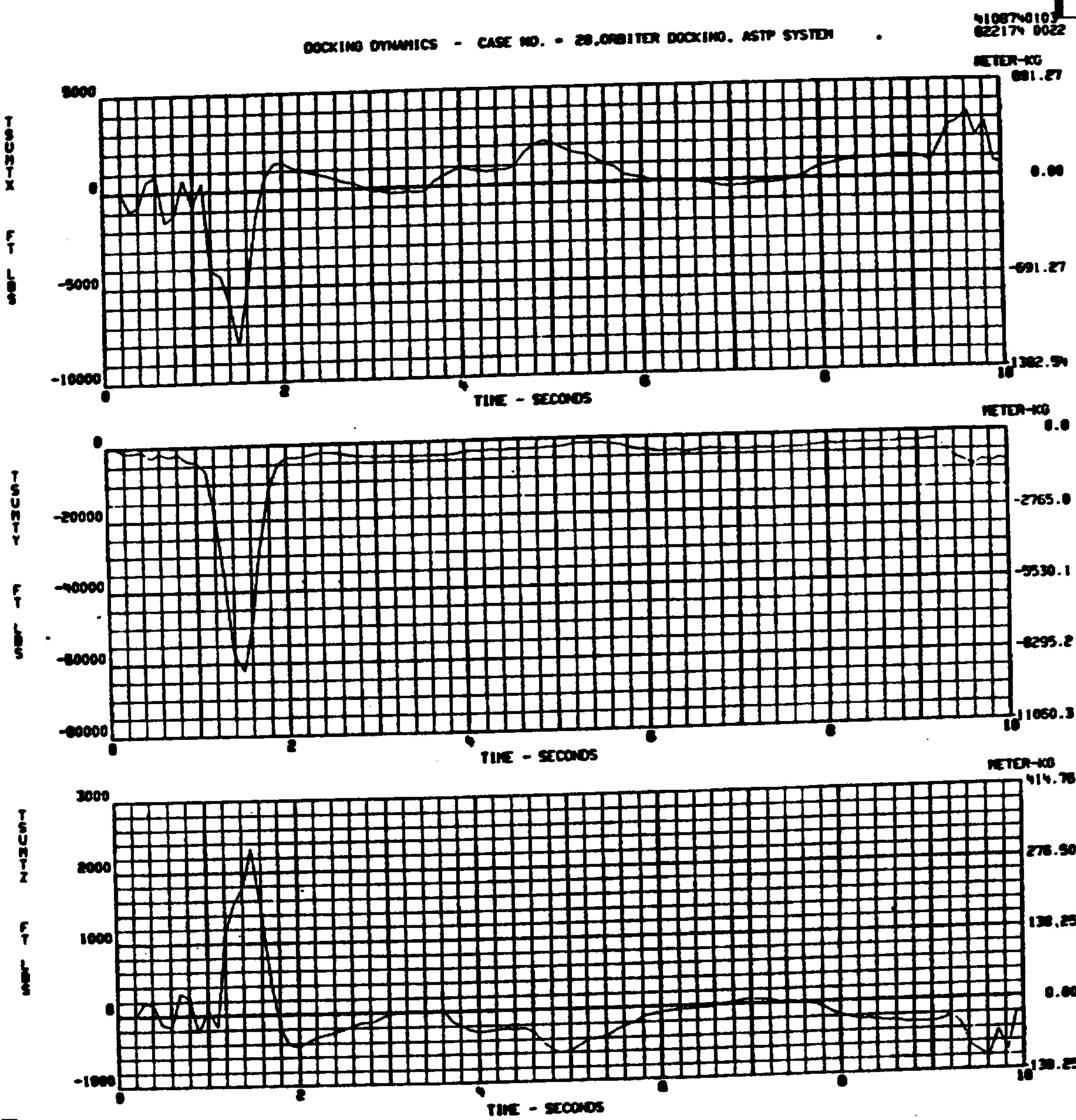

4108740103
022174 0019
DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
FSUMTX LBS
KG
2500
2000
1500
1000
500
0
1133.9
907.1
680.3
453.5
226.7
0.0
TIME - SECONDS
FSUMTY LBS
100
0
-100
-200
-300
45.3
0.0
-45.3
-90.7
136.0
TIME - SECONDS
FSUMTZ LBS
2000
1500
1000
500
0
-500
907.18
680.38
453.59
226.79
0.00
226.79
TIME - SECONDS

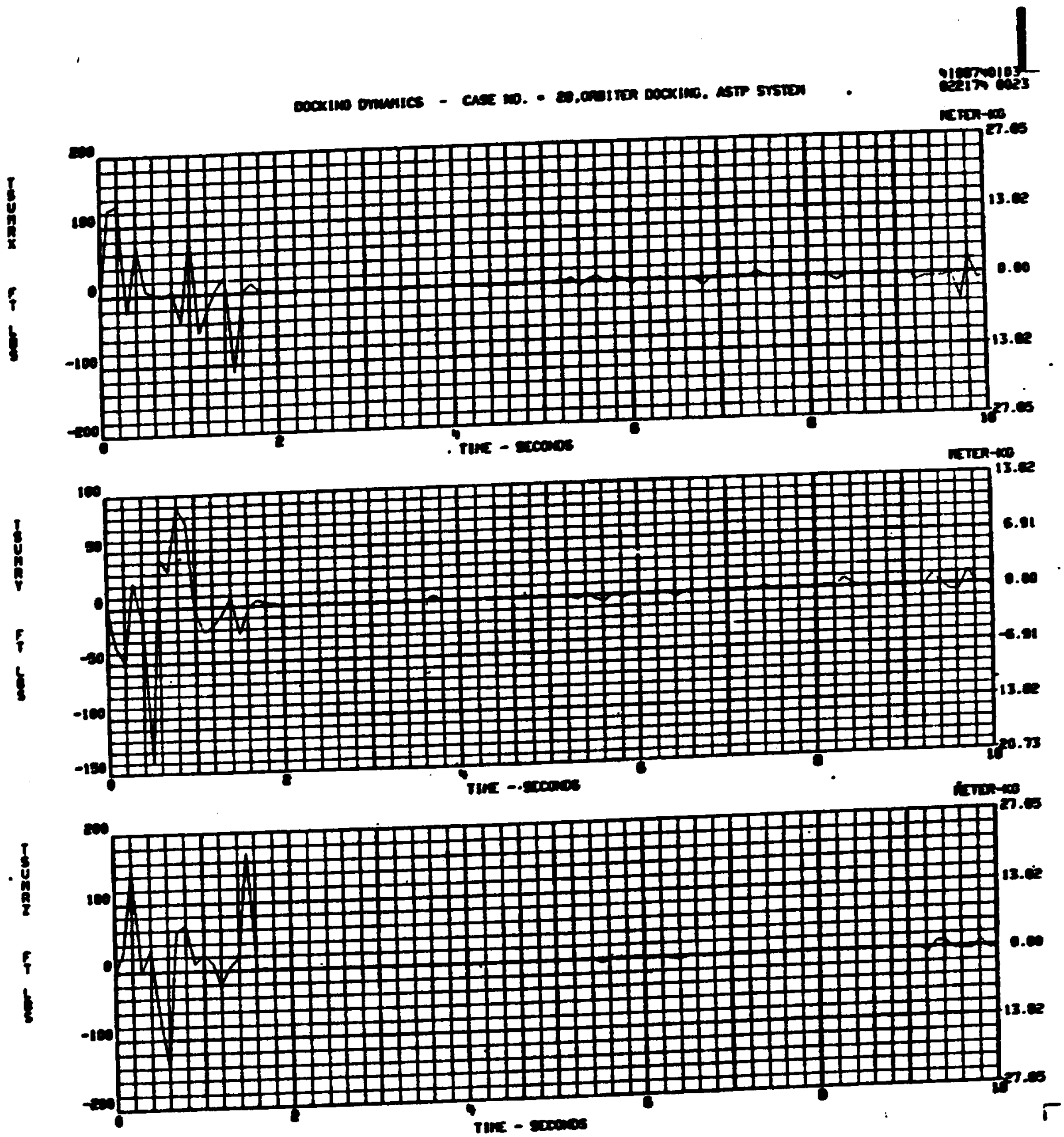
DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM

4108740103
082174 0020




DOCKING DYNAMICS - CASE NO. - 28.ORBITER DOCKING, ASTP SYSTEM
TSUMAX FT LBS
TSUMAY FT LBS
TSUMAZ FT LBS
TIME - SECONDS
METER-KG
691.27
0.00
-691.27
-1382.54
2765.0
0.0
-2765.0
-5530.1
-8295.2
-11060.3
414.76
276.50
138.25
-138.25
5000
0
-5000
-10000
20000
-20000
-40000
-60000
-80000
3000
2000
1000
-1000
0
2
4
6
8
10


DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING. ASTP SYSTEM
METER-KG
TSUMTX FT LBS
5000
0
-5000
-10000
0.00
-691.27
TIME - SECONDS
METER-KG
TSUMTY FT LBS
0
-20000
-40000
-60000
-80000
0.0
-2765.0
-5530.1
-8295.2
-11060.3
TIME - SECONDS
METER-KG
TSUMTZ FT LBS
3000
2000
1000
0
-1000
414.76
276.50
138.25
0.00
-138.25
TIME - SECONDS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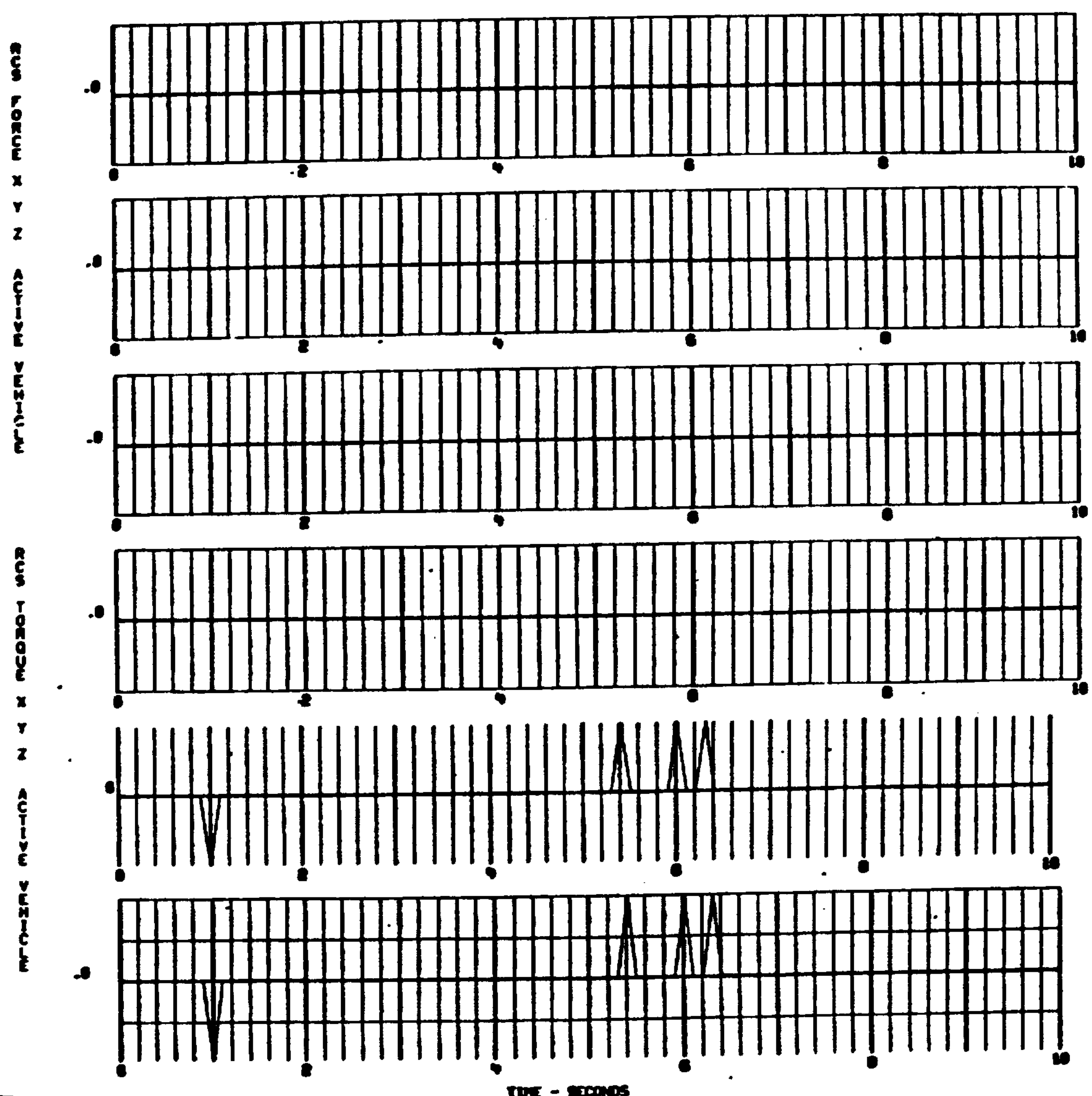
41887401837
022174 0023
TSUMRX FT LBS
METER-KG
TIME - SECONDS
TSUMRY FT LBS
TIME -- SECONDS
TSUMRZ FT LBS
TIME - SECONDS

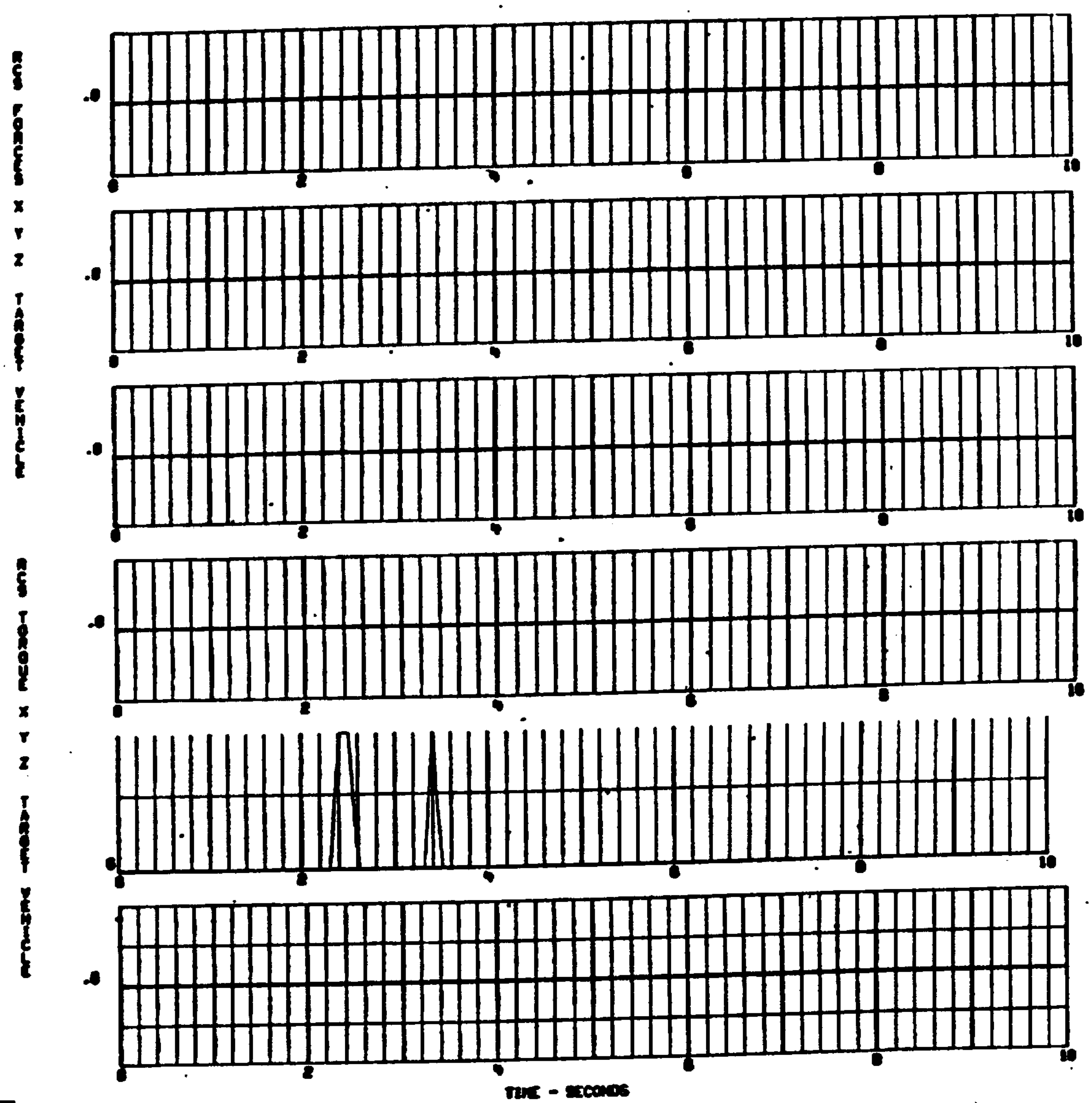
DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM

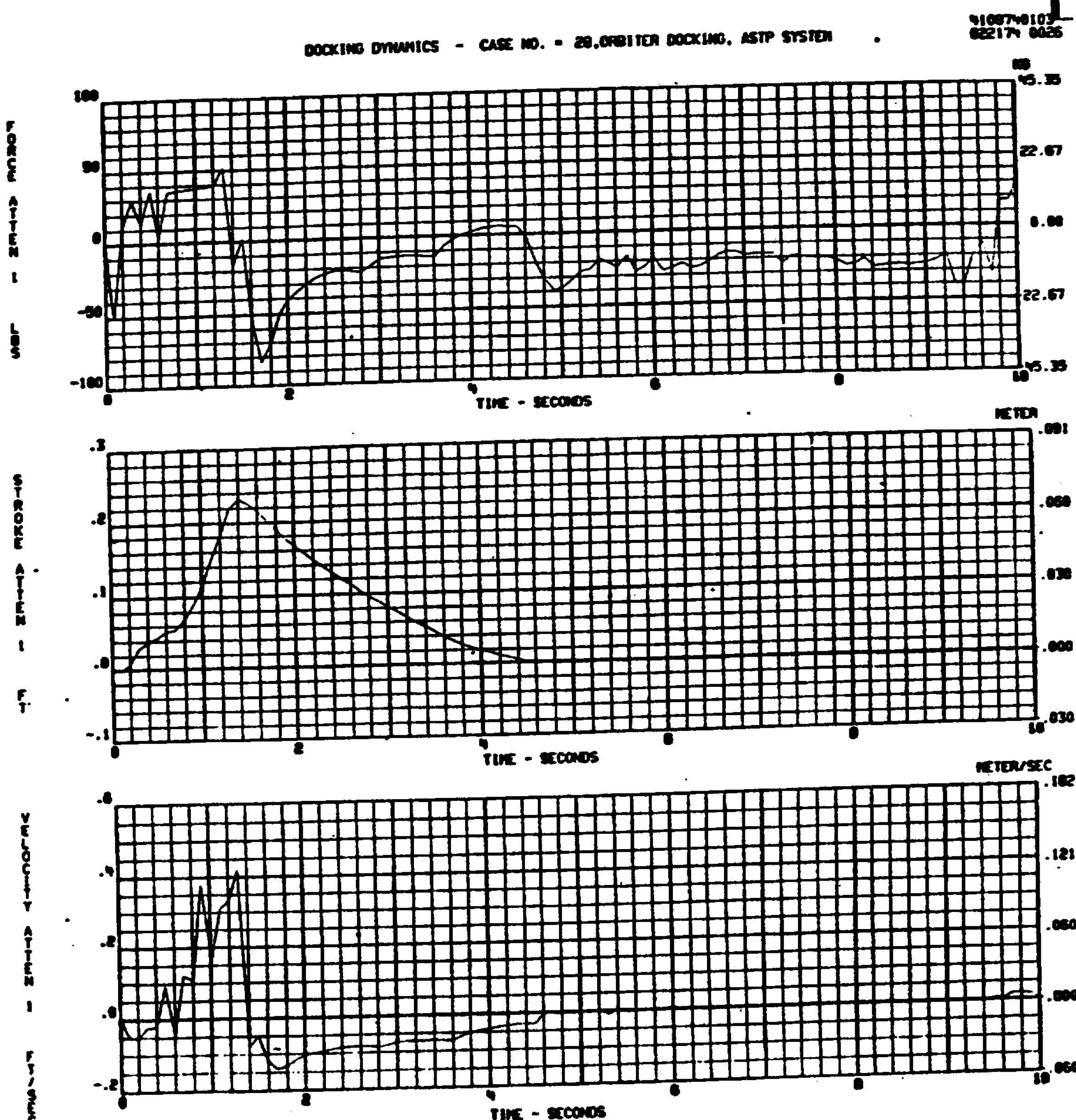
4108740103
082174 8024

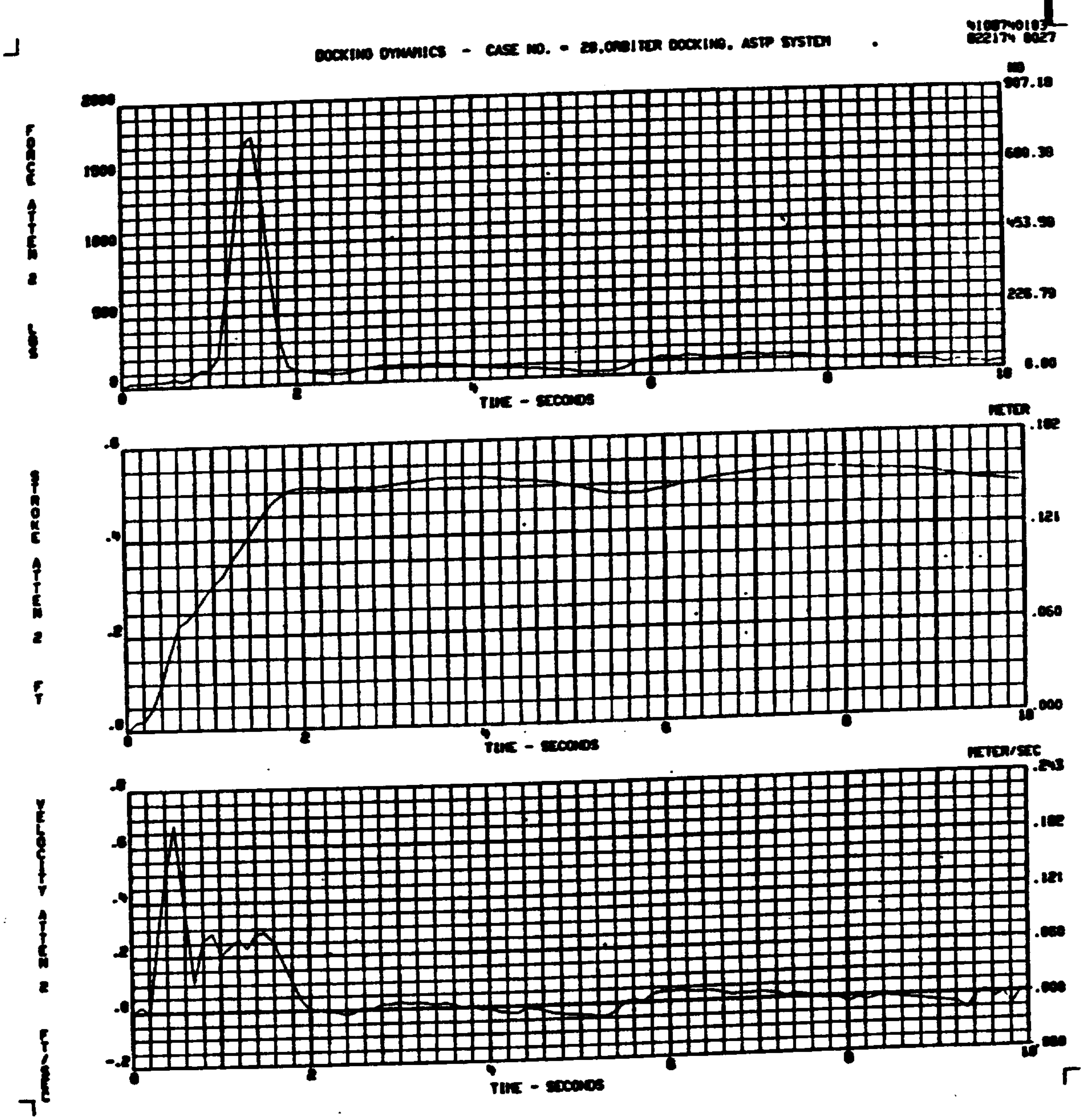


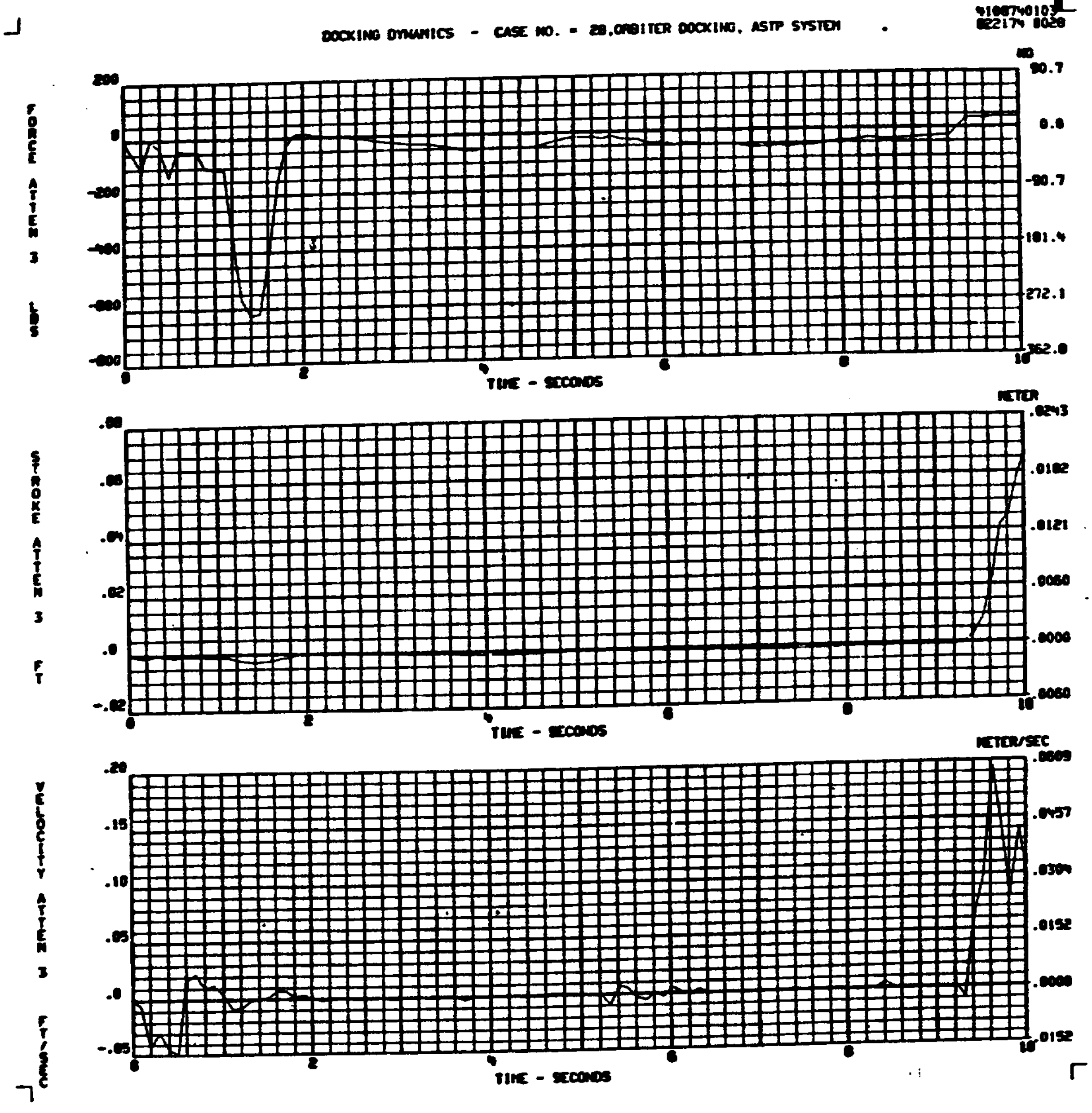
4100740103
082174 0025

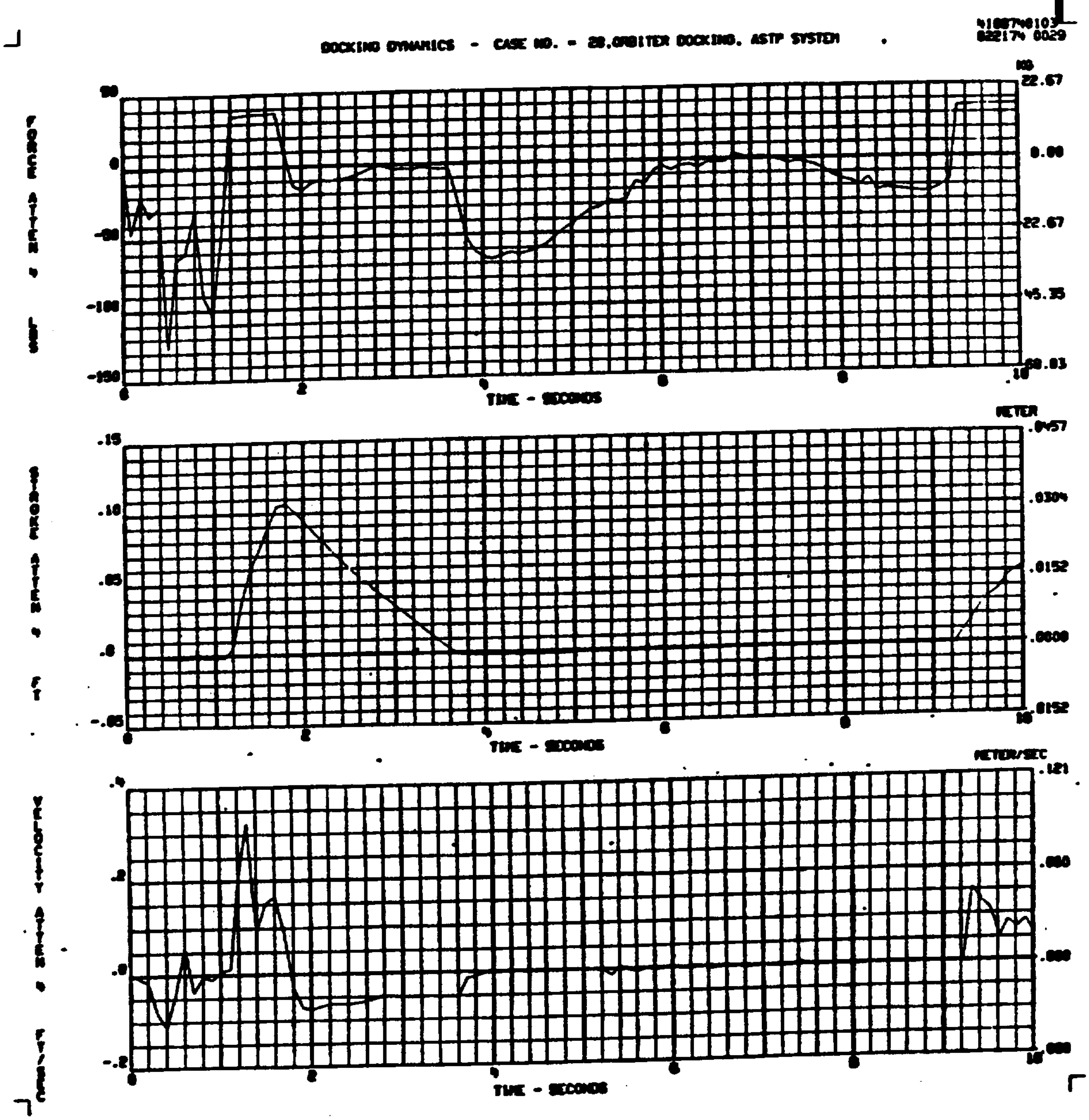
DOCKING DYNAMICS - CASE NO. = 20,ORBITER DOCKING, ASTP SYSTEM

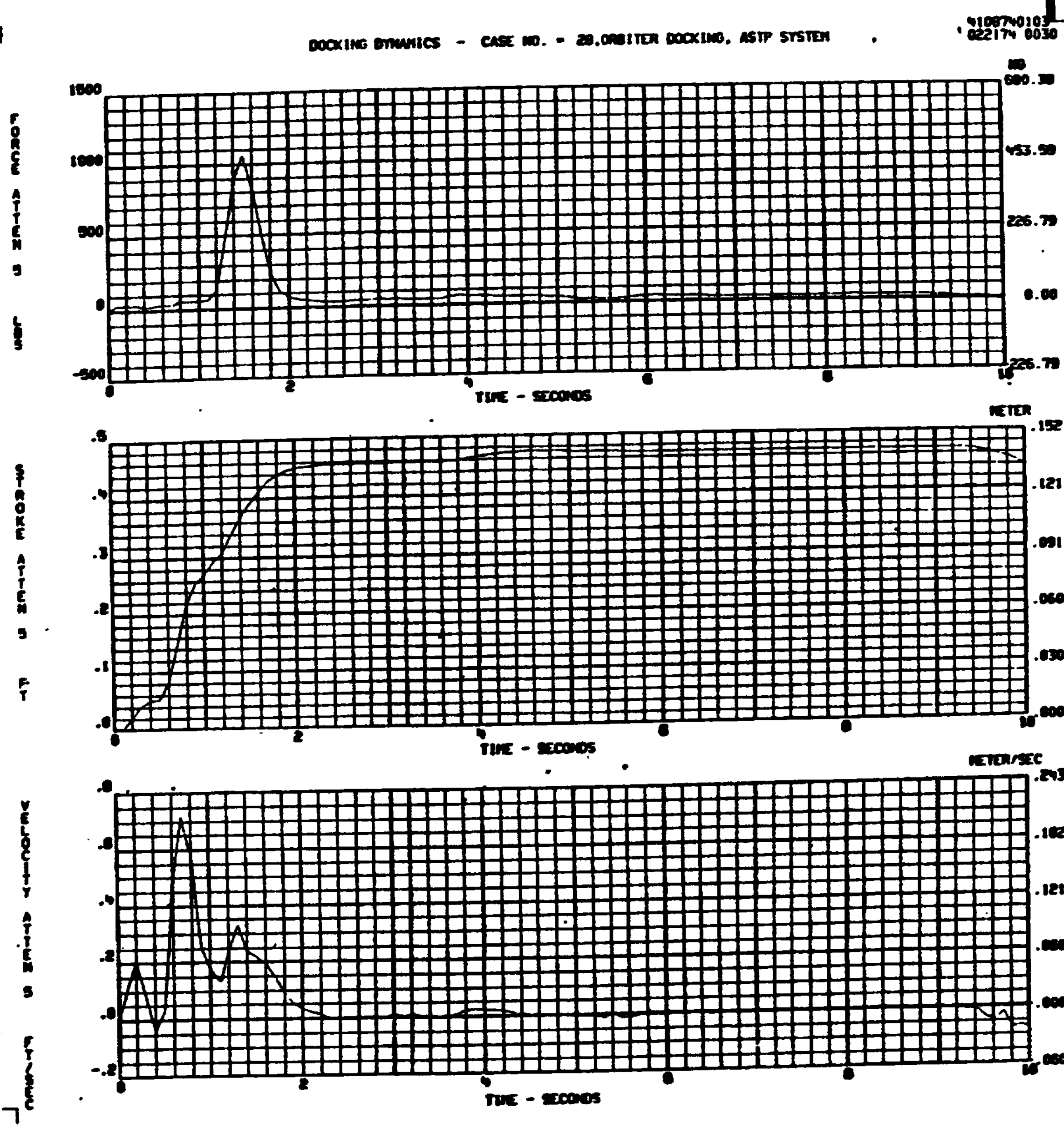


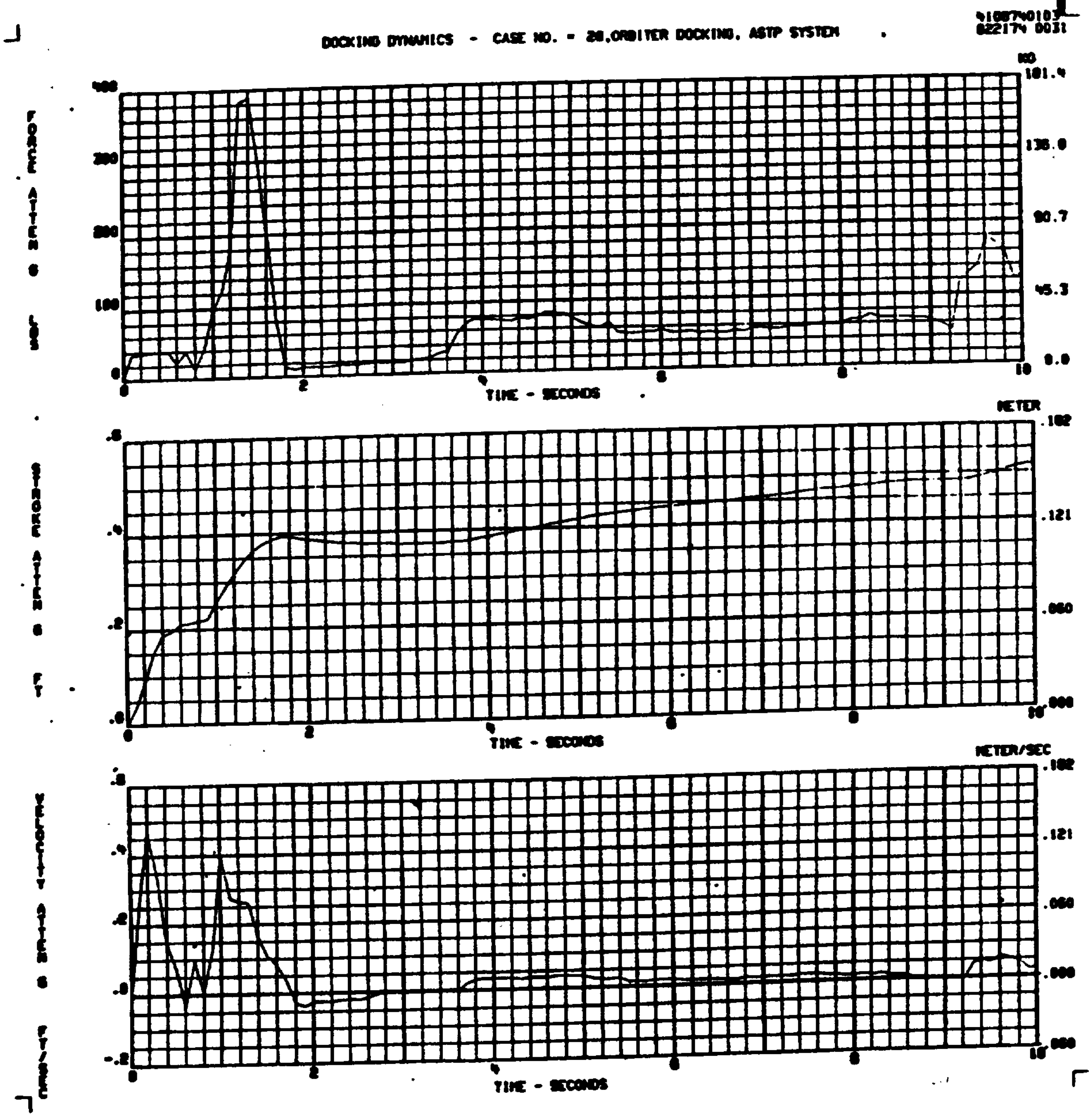

DOCKING DYNAMICS - CASE NO. = 20.ORBITER DOCKING, ASTP SYSTEM
FORCE ATTEN 1 LBS
TIME - SECONDS
STROKE ATTEN 1 FT
METER
TIME - SECONDS
VELOCITY ATTEN 1 FT/SEC
METER/SEC
TIME - SECONDS


DOCKING DYNAMICS - CASE NO. - 28,ORBITER DOCKING, ASTP SYSTEM
FORCE ATTEN 2 LBS
TIME - SECONDS
STROKE ATTEN 2 FT
METER
TIME - SECONDS
VELOCITY ATTEN 2 FT/SEC
METER/SEC
TIME - SECONDS

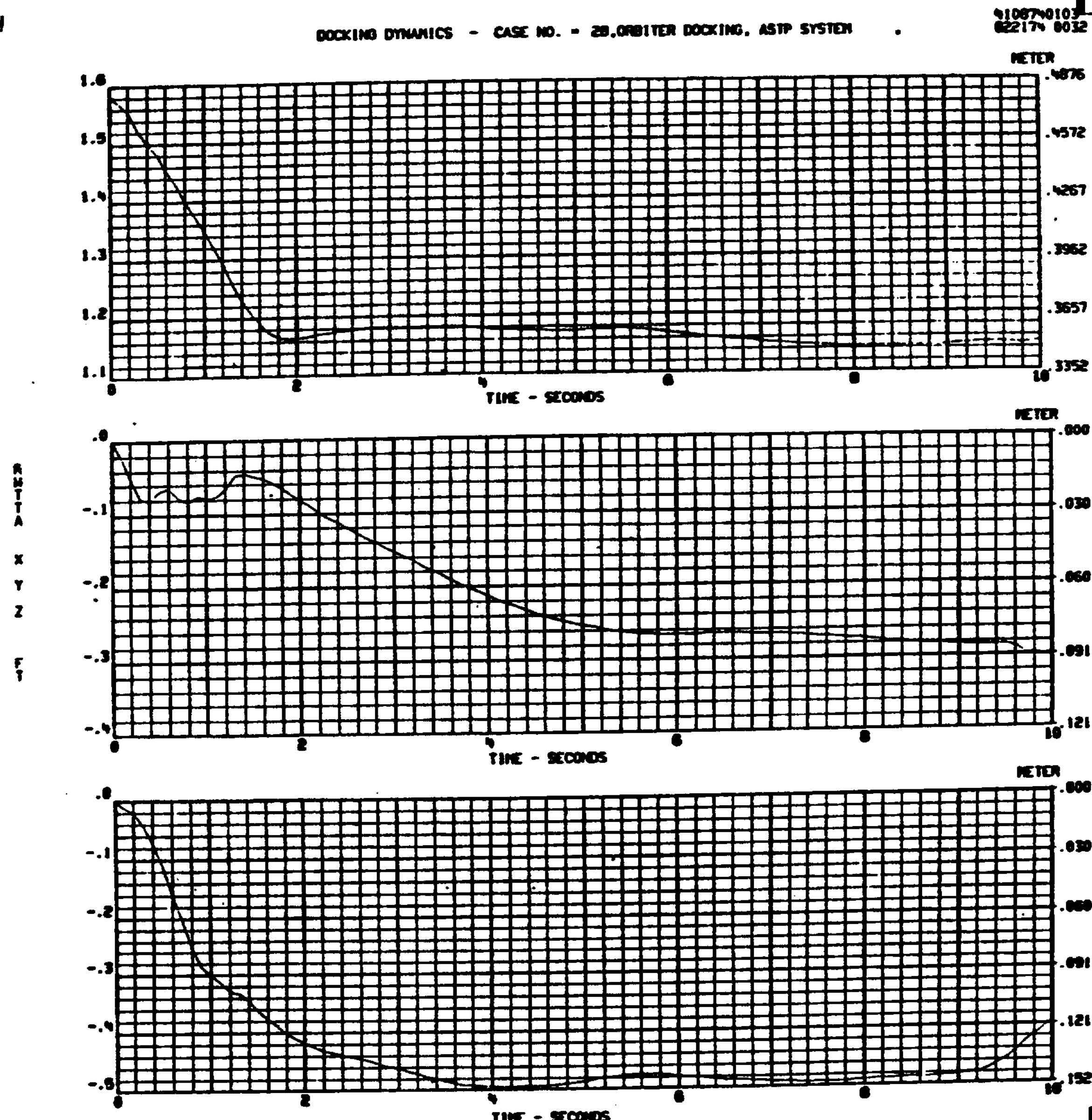

DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM
4108740103
822174 8028
FORCE ATTEN 3 LBS
200
0
-200
-400
-600
-800
90.7
0.0
-90.7
181.4
272.1
362.8
TIME - SECONDS
0
2
4
6
8
10
STROKE ATTEN 3 FT
METER
.08
.06
.04
.02
.0
-.02
.0243
.0182
.0121
.0060
.0000
.0060
TIME - SECONDS
VELOCITY ATTEN 3 FT/SEC
METER/SEC
.20
.15
.10
.05
.0
-.05
.0609
.0457
.0304
.0152
.0000
.0152
TIME - SECONDS


DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
FORCE ATTEN 4 LBS
TIME - SECONDS
KG
STROKE ATTEN 4 FT
TIME - SECONDS
METER
VELOCITY ATTEN 4 FT/SEC
TIME - SECONDS
METER/SEC


DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM
FORCE ATTEN 5 LBS
1500
1000
500
0
-500
680.38
453.59
226.79
0.00
-226.79
TIME - SECONDS
0
2
4
6
8
10
STROKE ATTEN 5 FT
.5
.4
.3
.2
.1
.0
METER
.152
.121
.091
.060
.030
.000
TIME - SECONDS
VELOCITY ATTEN 5 FT/SEC
.8
.6
.4
.2
.0
-.2
METER/SEC
.243
.182
.121
.060
.000
-.060
TIME - SECONDS

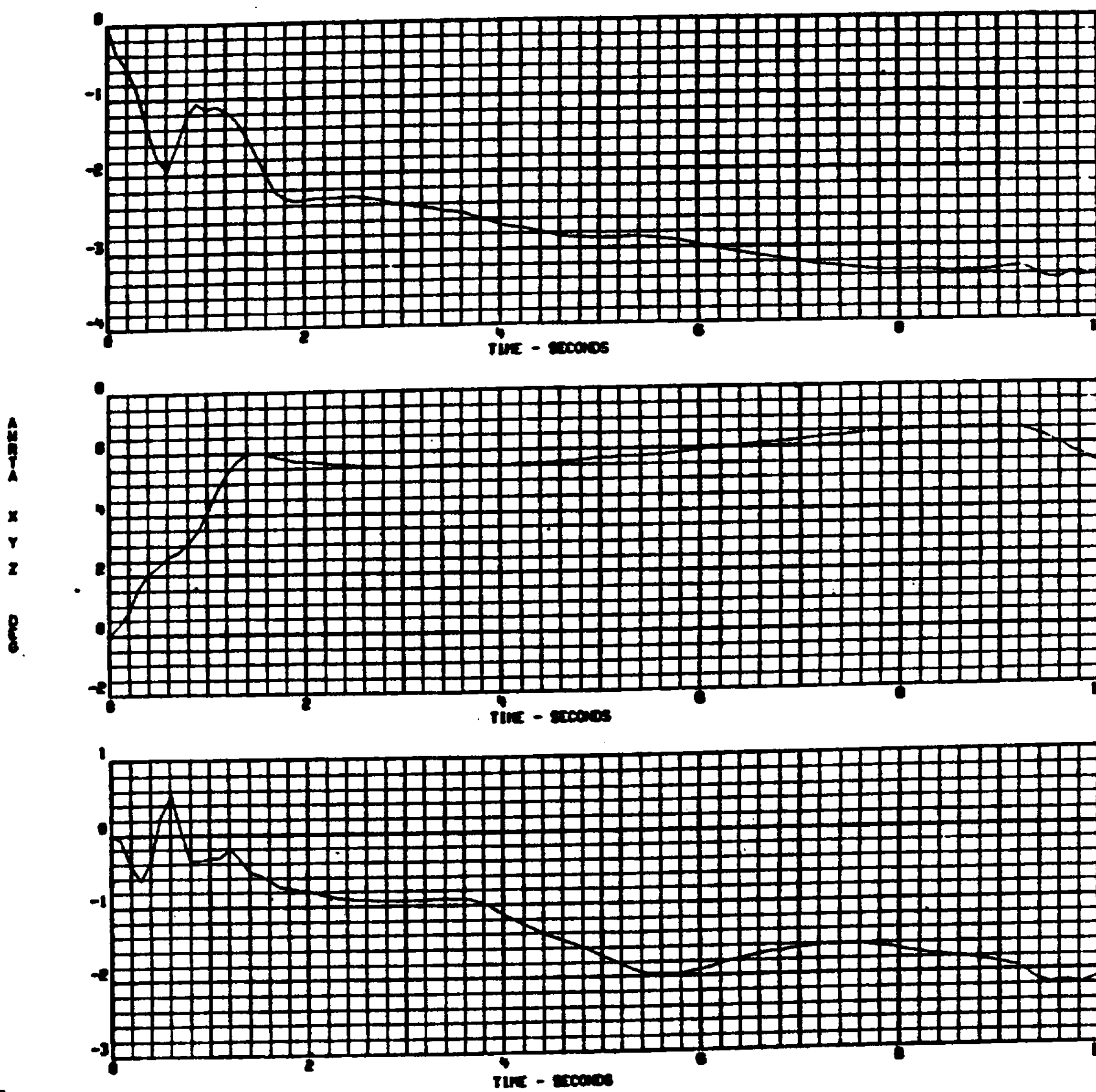

DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM
TIME - SECONDS
TIME - SECONDS
TIME - SECONDS
METER
METER/SEC

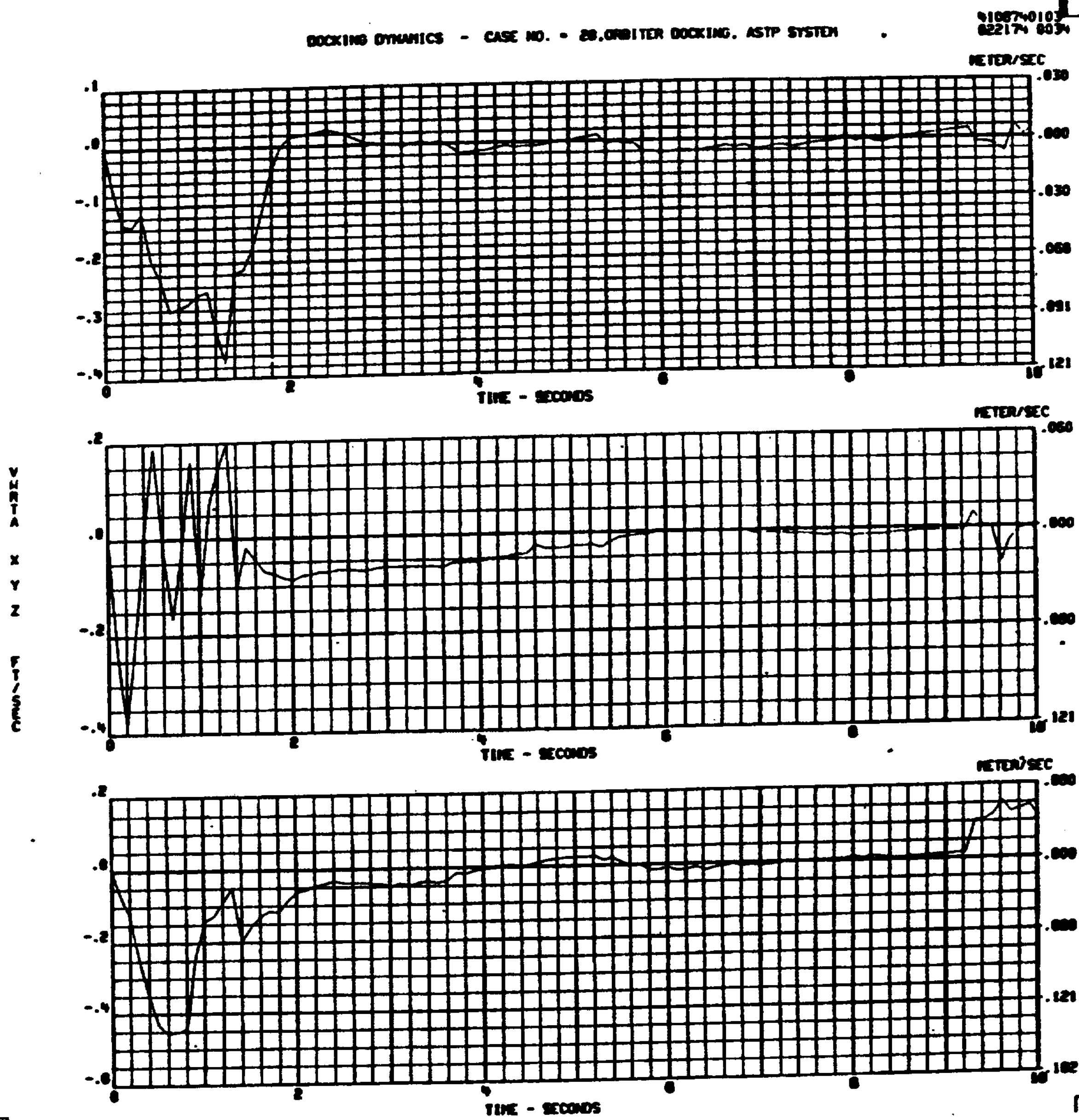
DOCKING DYNAMICS - CASE NO. - 28.ORBITER DOCKING, ASTP SYSTEM



DOCKING DYNAMICS - CASE NO. = 20.ORBITER DOCKING. ASTP SYSTEM .

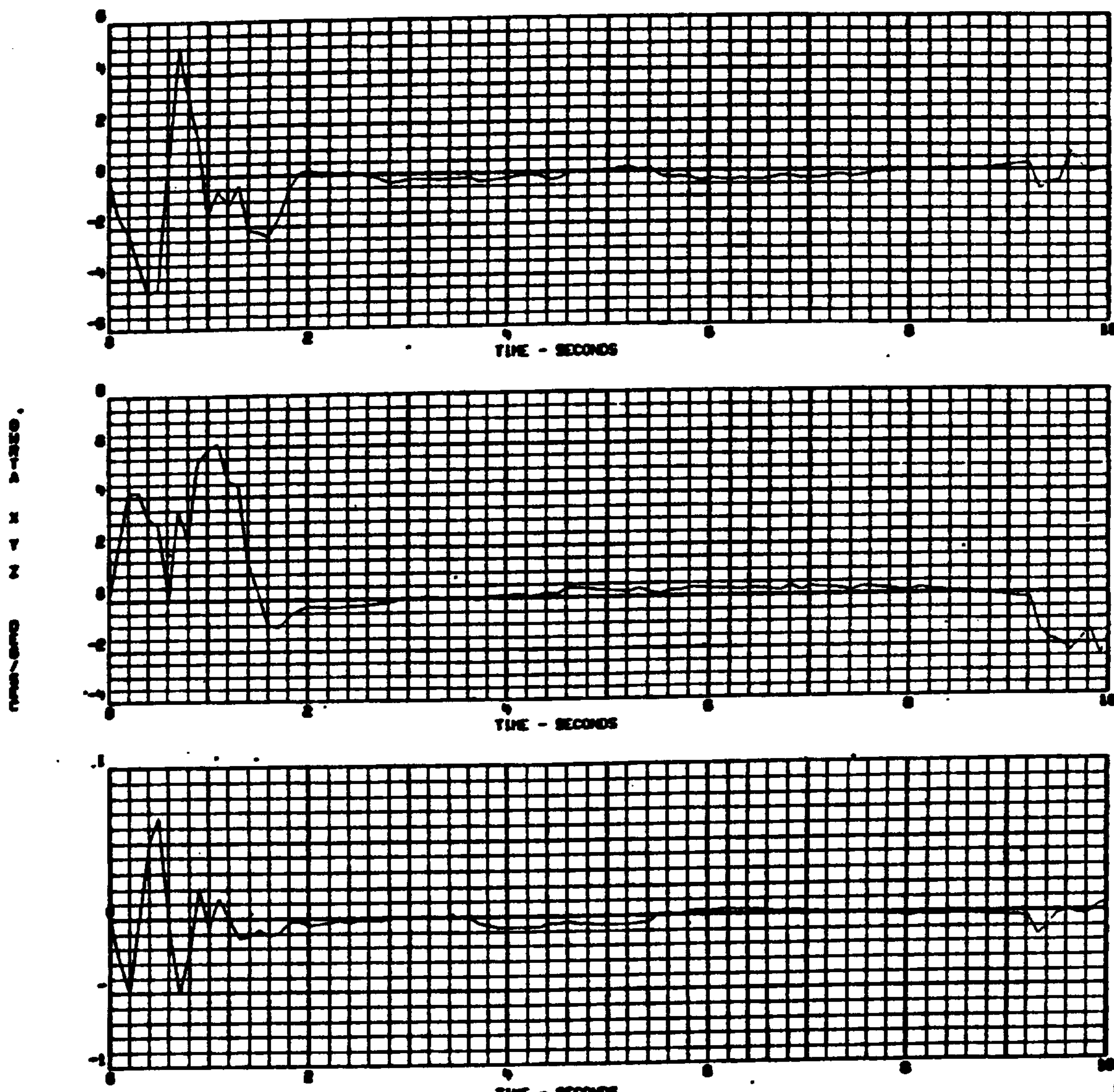
910874010?
022174 0033

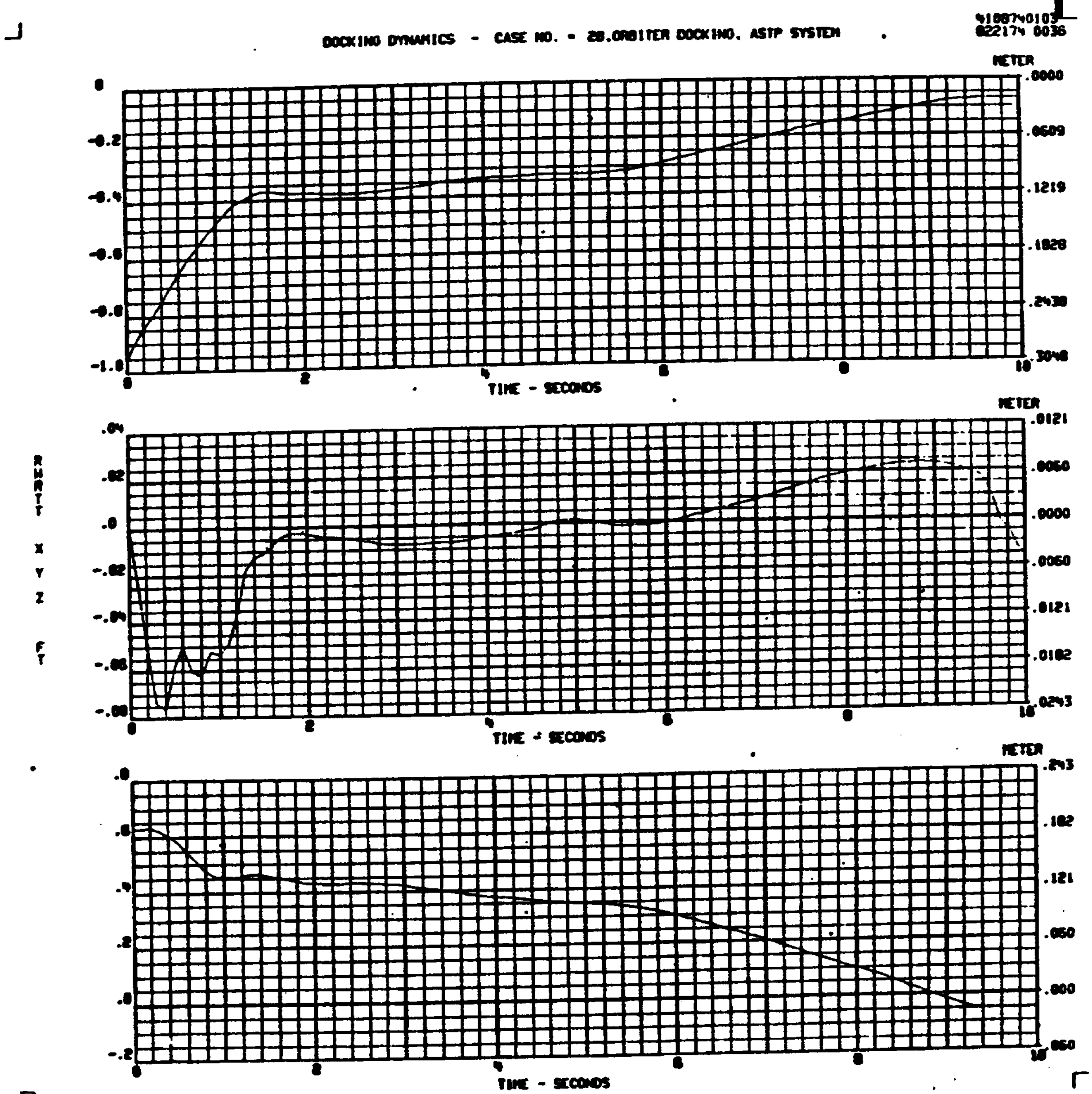



DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM
METER/SEC
TIME - SECONDS
VHRTA X Y Z FT/SEC

DOCKING DYNAMICS - CASE NO. = 28, ORBITER DOCKING, ASTP SYSTEM

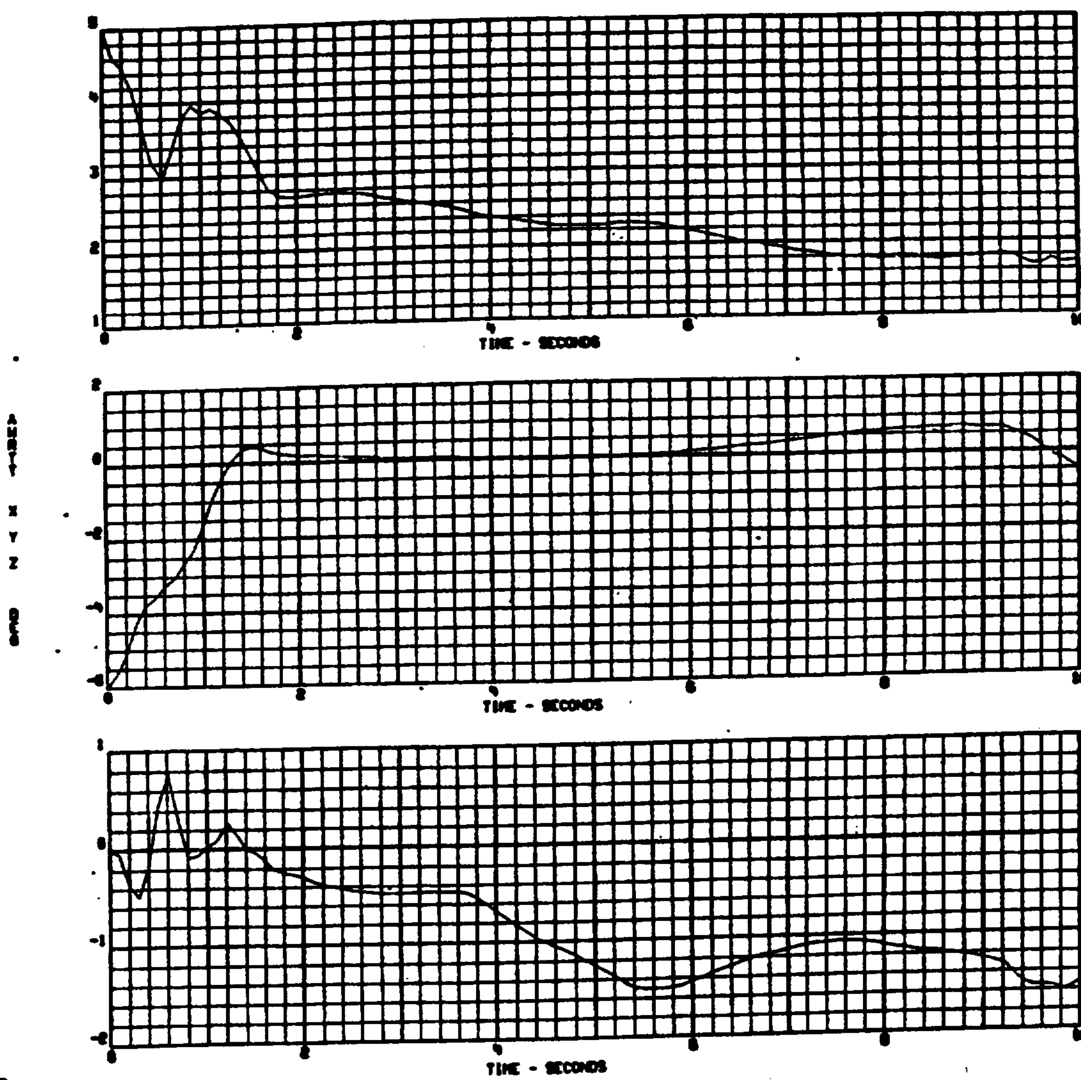
4100740103
082174 0035

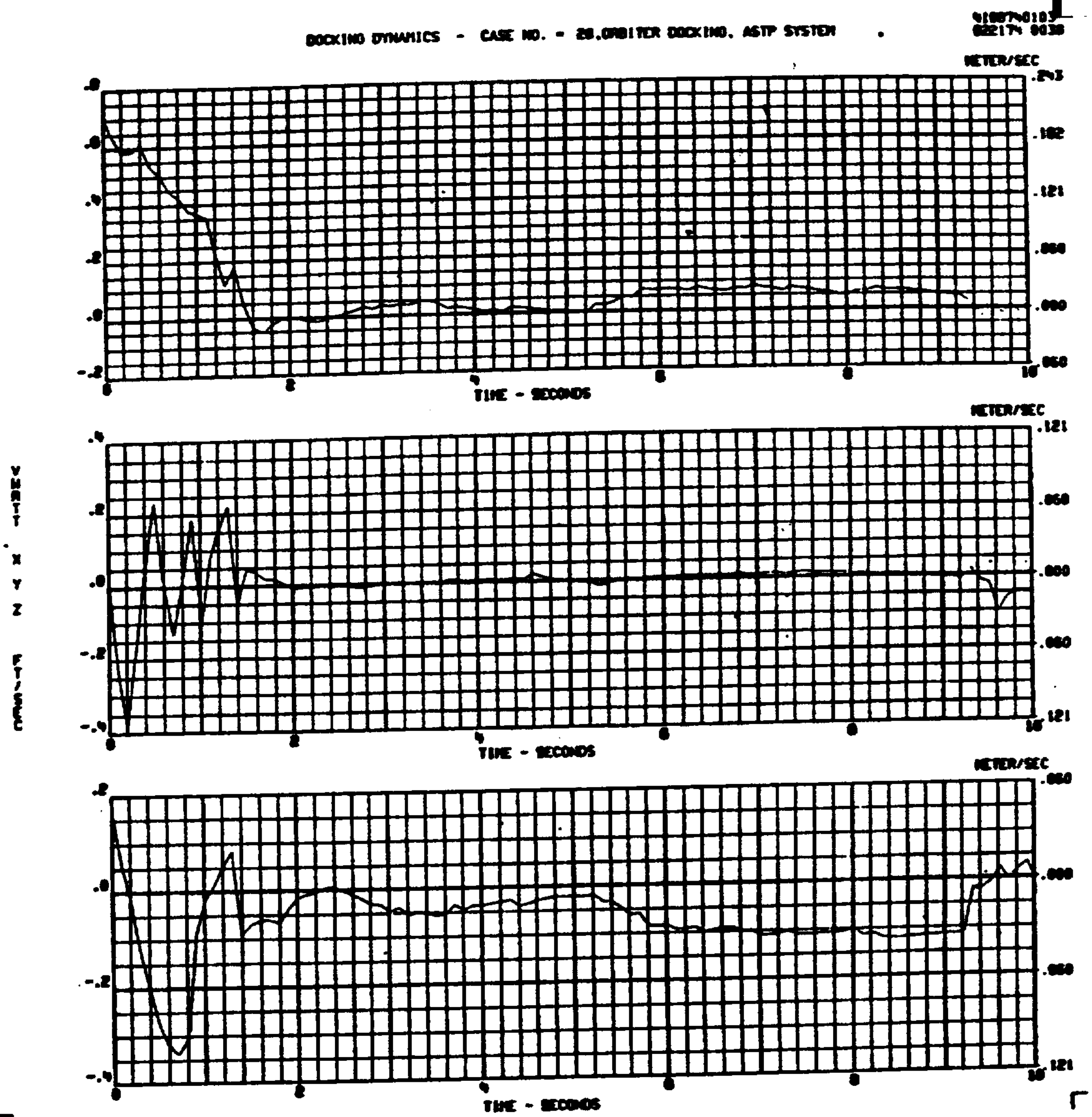



DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
022174 0036
METER
TIME - SECONDS
TIME - SECONDS
TIME - SECONDS
X
Y
Z
FT

Space Division
Rockwell International

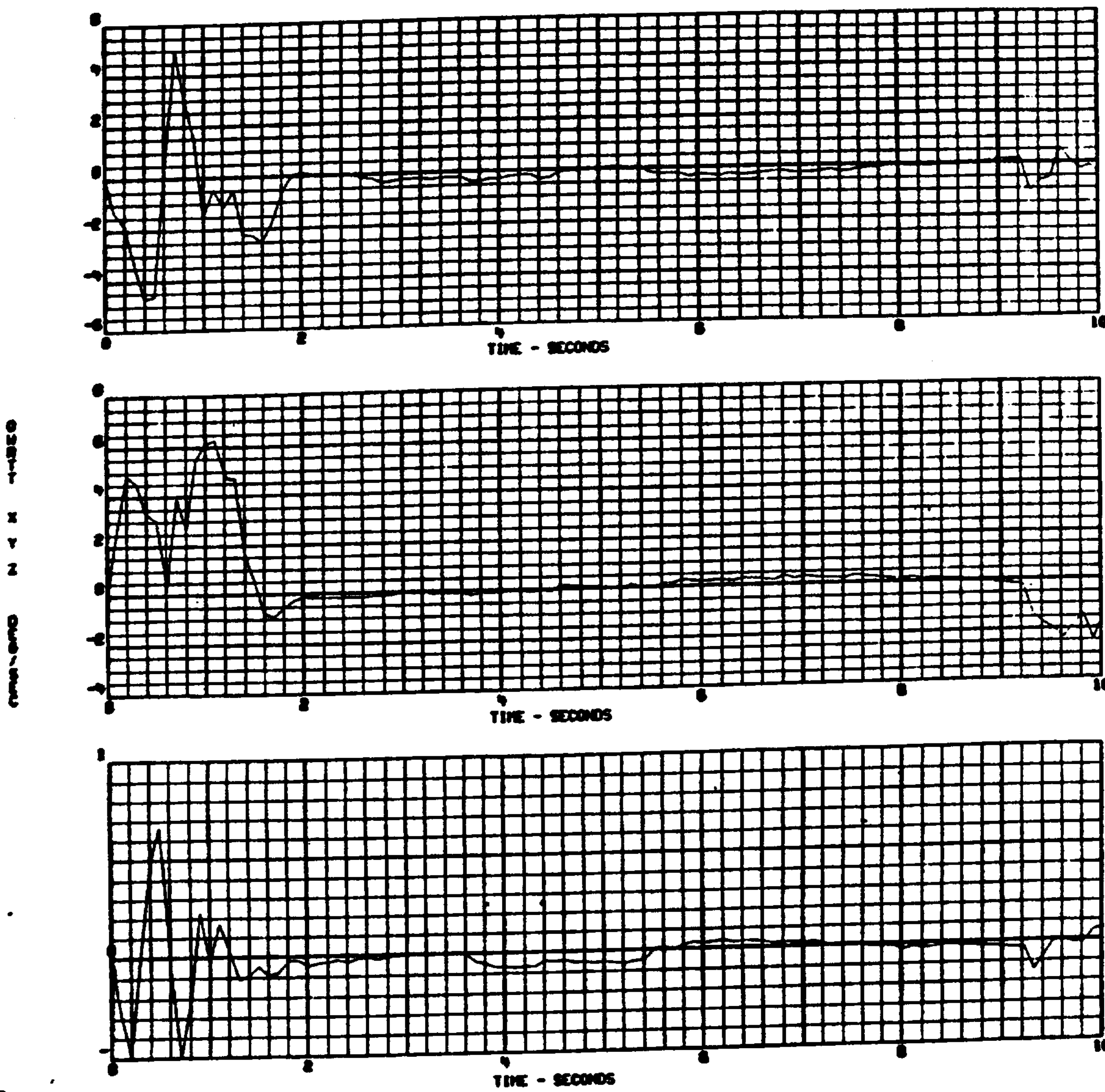
DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM

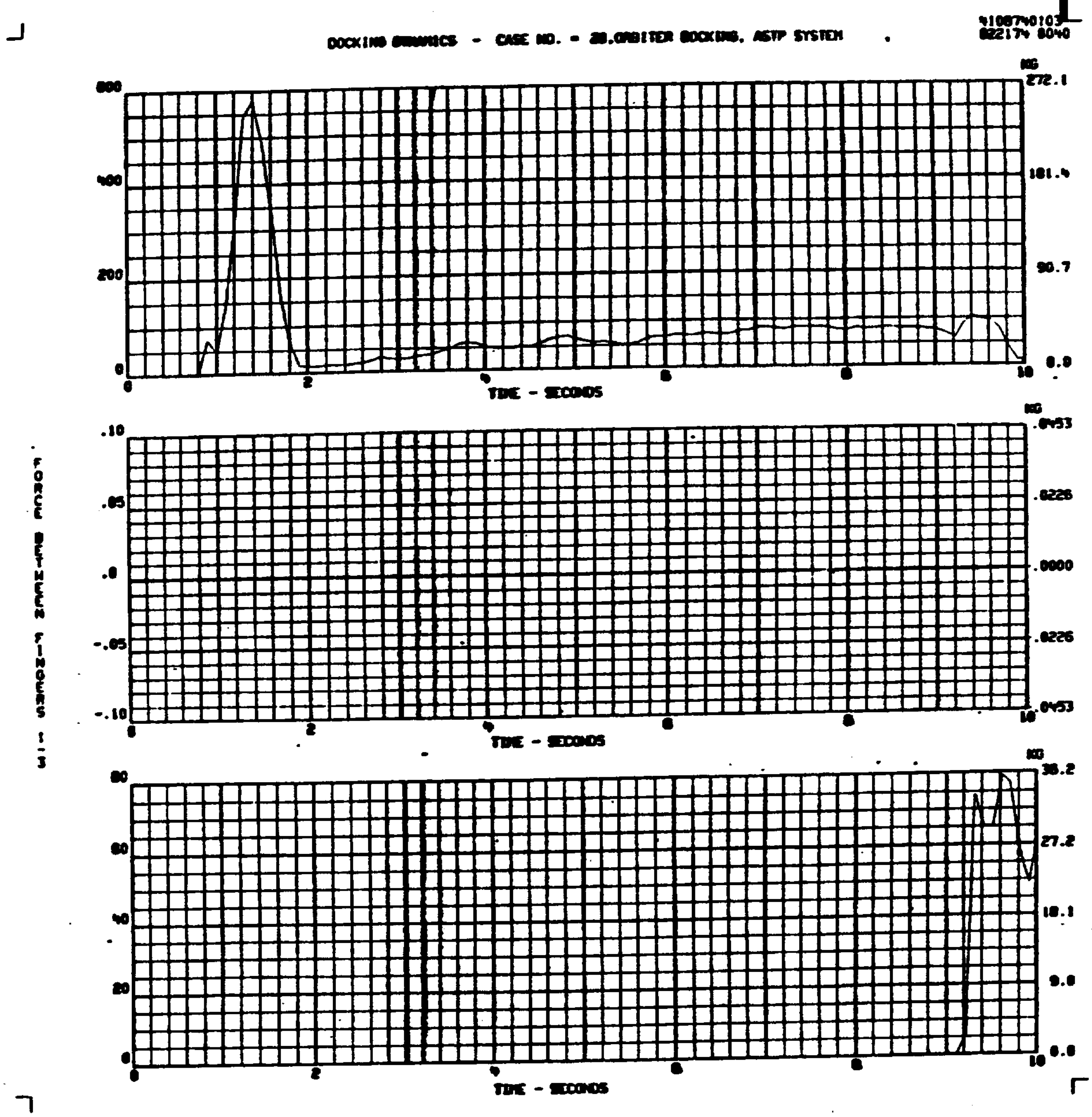


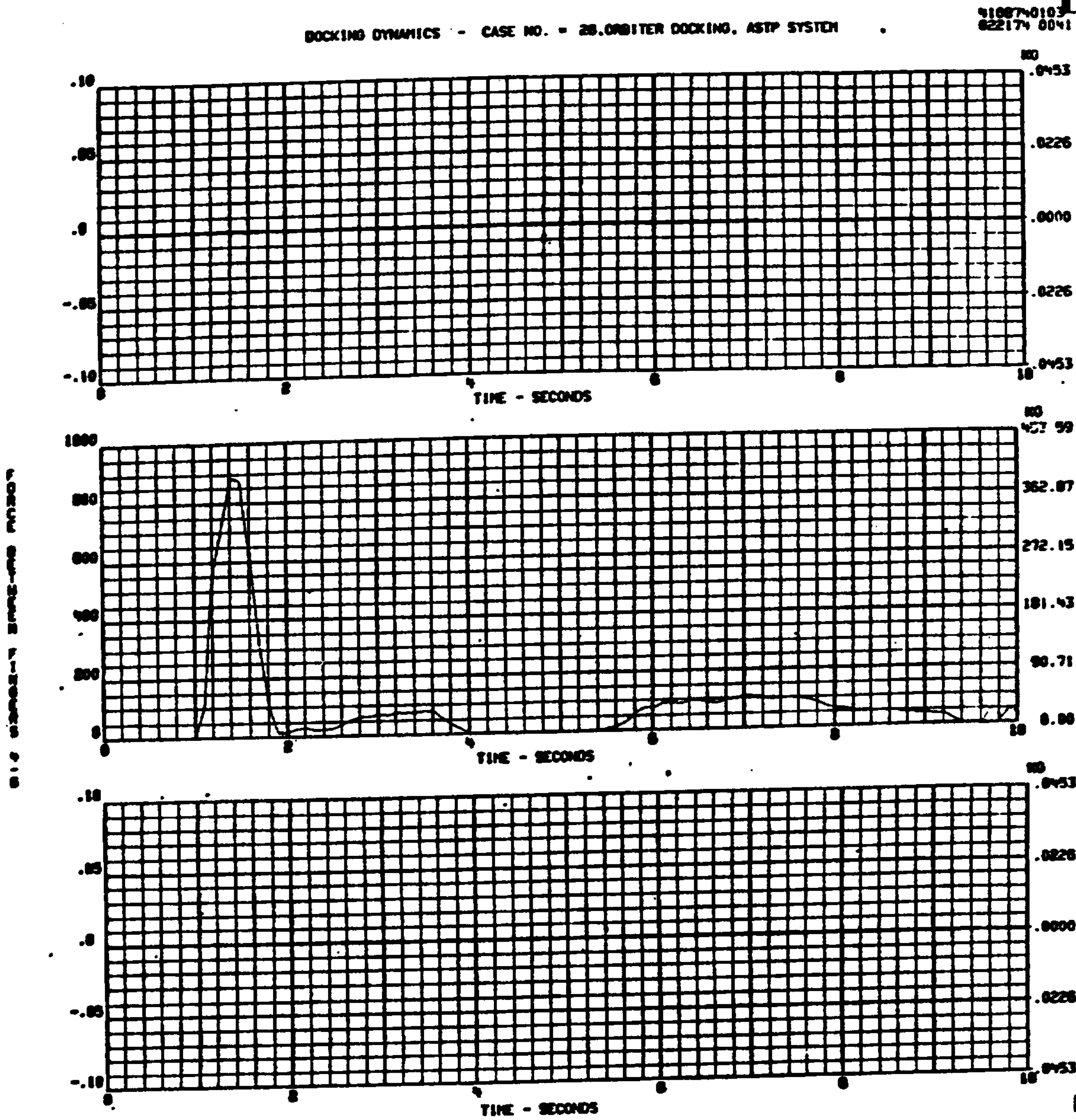

DOCKING DYNAMICS - CASE NO. - 28.ORBITER DOCKING, ASTP SYSTEM
METER/SEC
TIME - SECONDS
METER/SEC
TIME - SECONDS
METER/SEC
TIME - SECONDS

DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM

4108740103
822174 0039

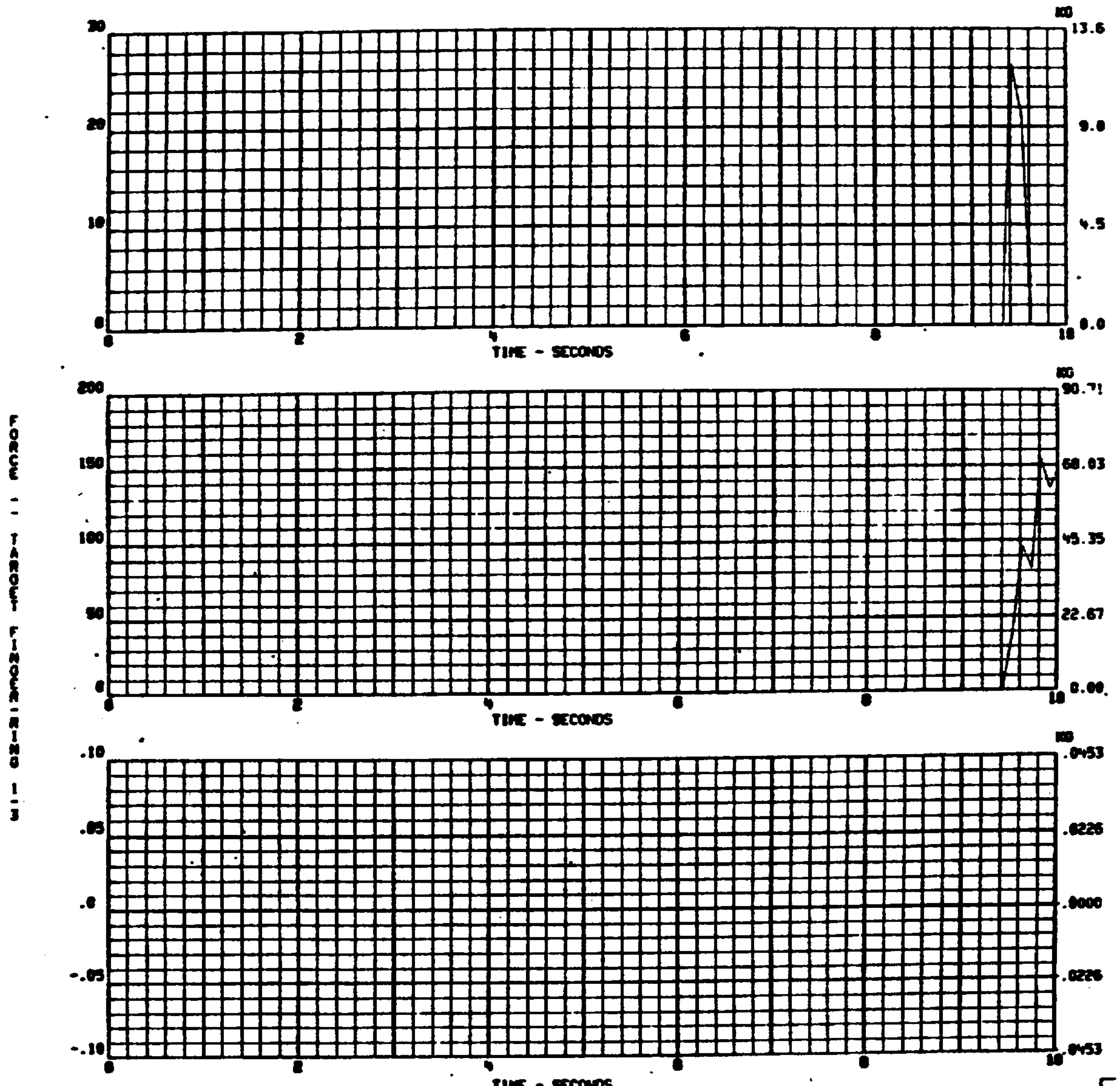


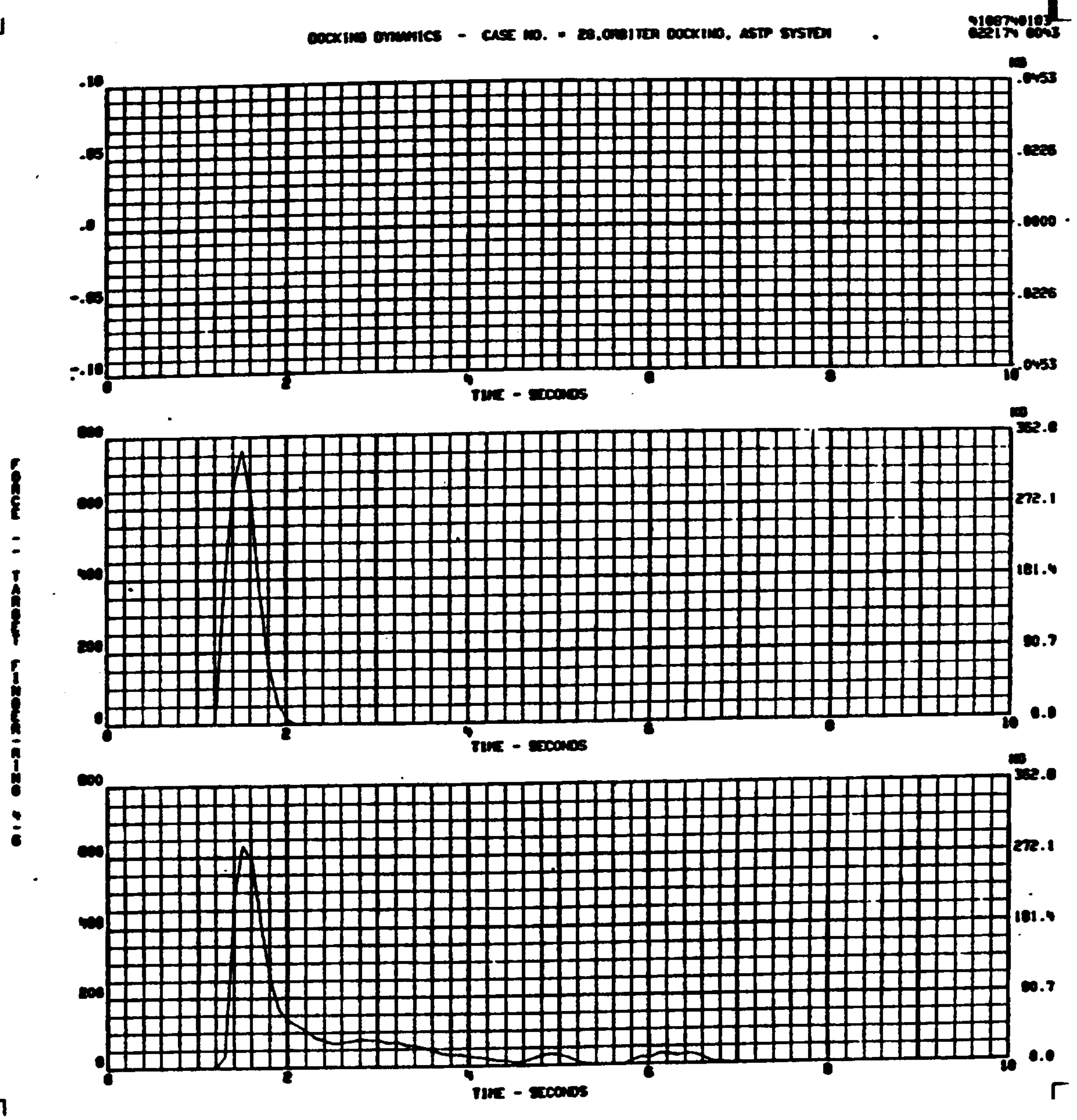

DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
4108740103
022174 0040
FORCE BETWEEN FINGERS 1-3
TIME - SECONDS
TIME - SECONDS
TIME - SECONDS
KG
272.1
181.4
90.7
0.0
.0453
.0226
.0000
.0226
.0453
38.2
27.2
18.1
9.0
0.0
800
400
200
0
.10
.05
.0
-.05
-.10
80
60
40
20
0
2
4
6
8
10

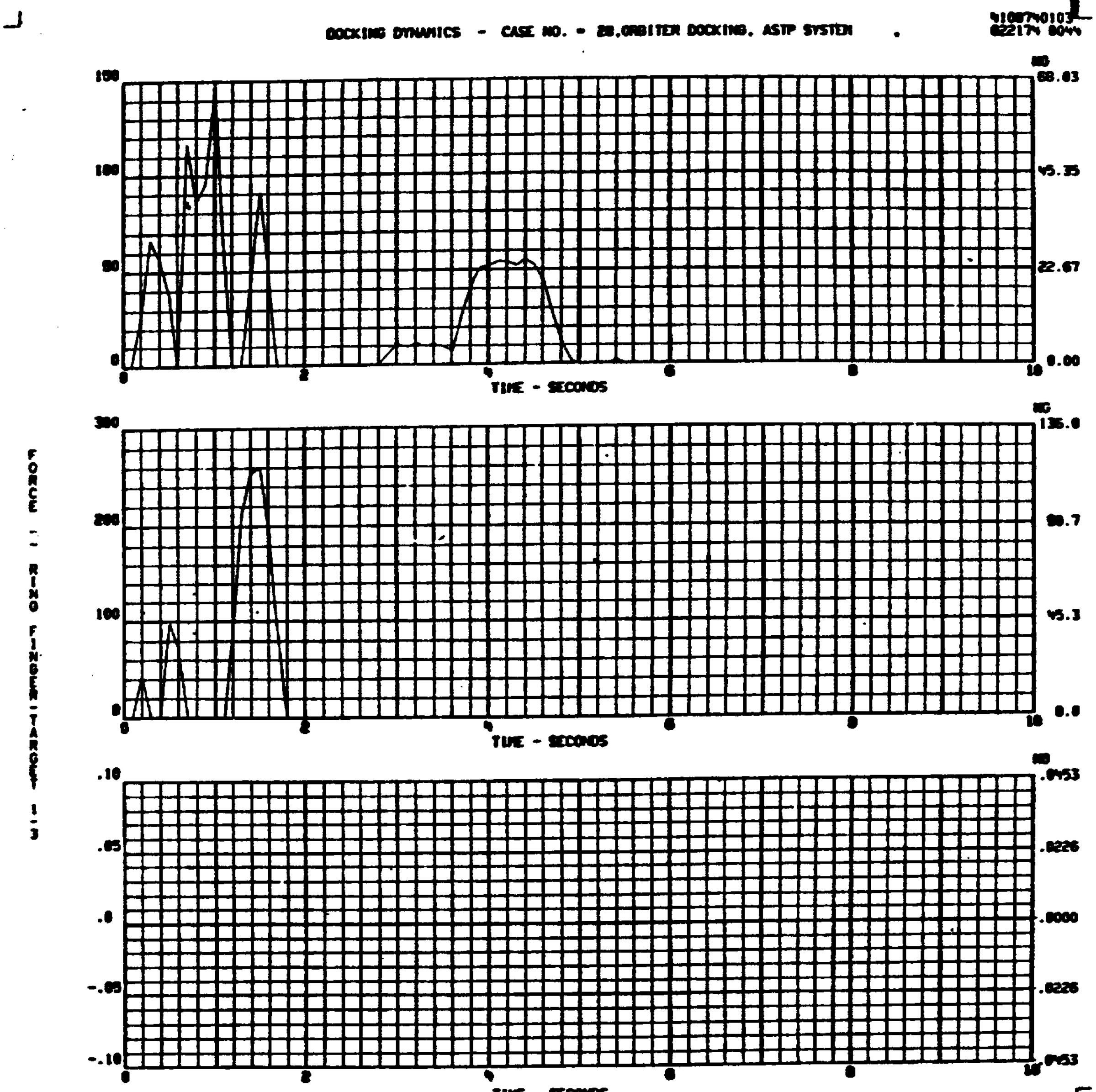

DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
TIME - SECONDS
FORCE BETWEEN FINGERS 4-6
TIME - SECONDS
TIME - SECONDS

DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM

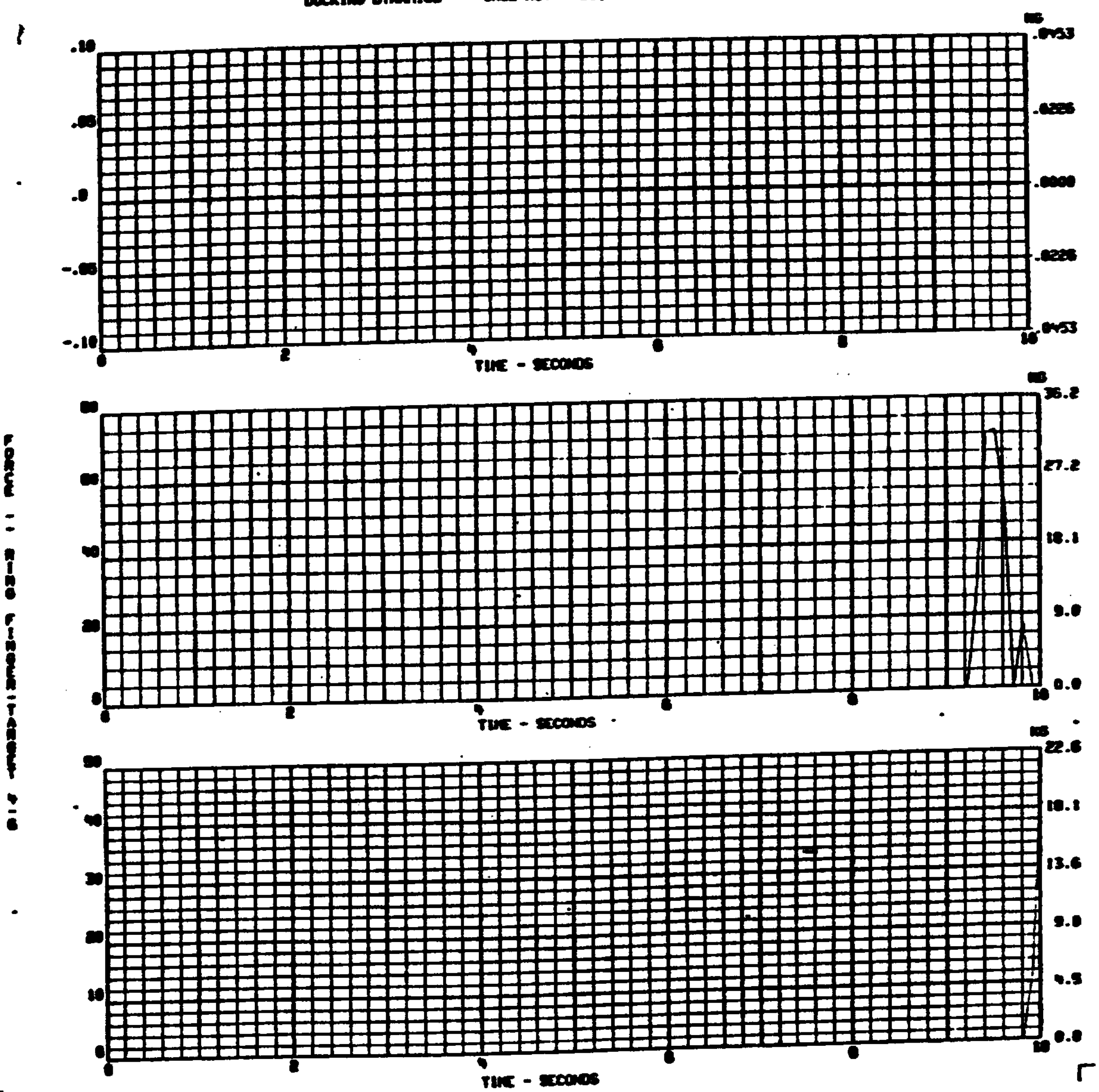
4108740103
822174 0042

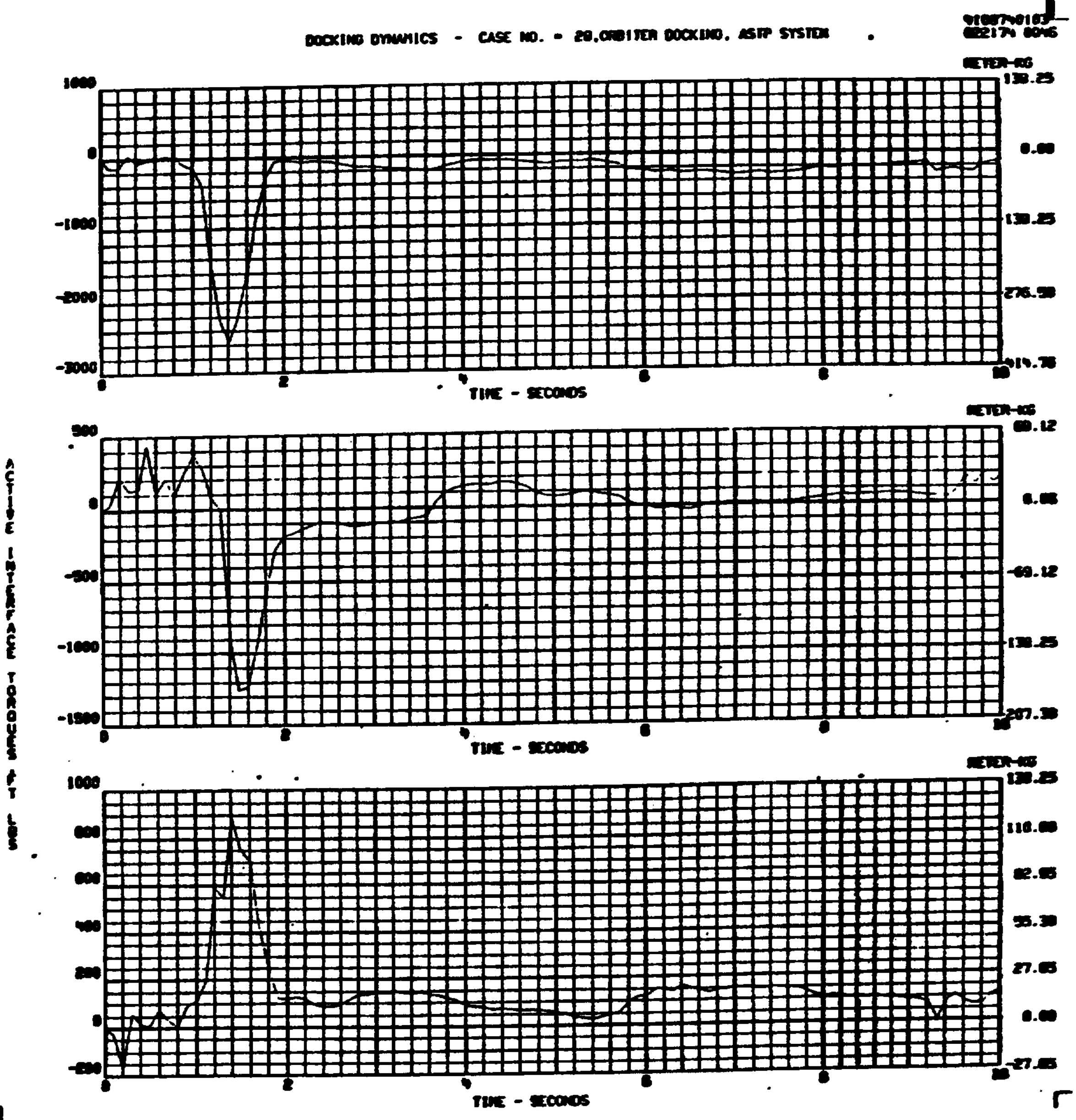



DOCKING DYNAMICS - CASE NO. = 28, ORBITER DOCKING, ASTP SYSTEM
TIME - SECONDS
TIME - SECONDS
TIME - SECONDS
362.8
272.1
181.4
90.7
0.0


DOCKING DYNAMICS - CASE NO. = 28.ORBITER DOCKING, ASTP SYSTEM
TIME - SECONDS
TIME - SECONDS
TIME - SECONDS
FORCE - RING FINGER-TARGET 1-3

DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM




DOCKING DYNAMICS - CASE NO. = 20,ORBITER DOCKING, ASTP SYSTEM
ACTIVE INTERFACE TORQUES FT LBS
METER-KG
TIME - SECONDS

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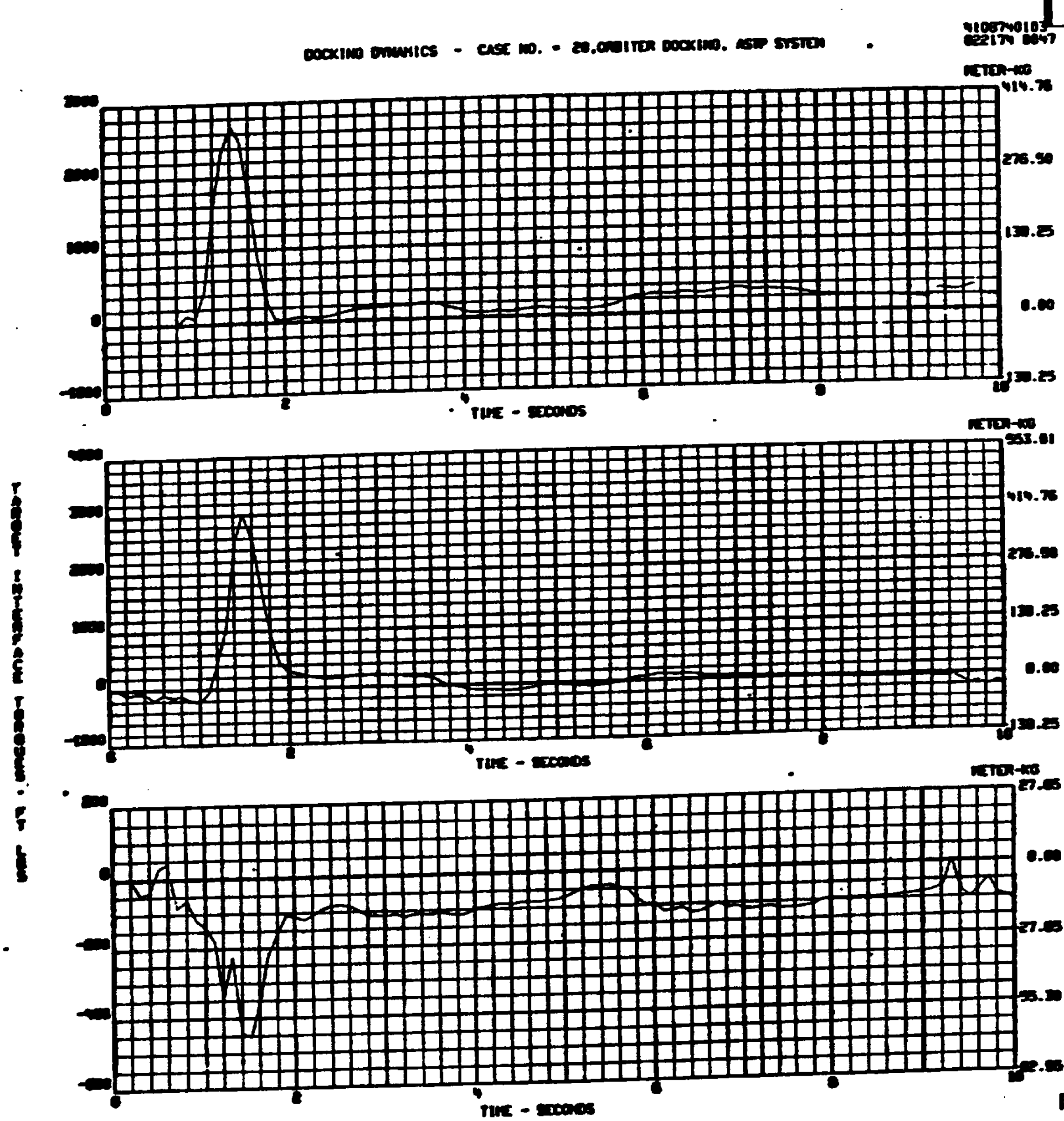
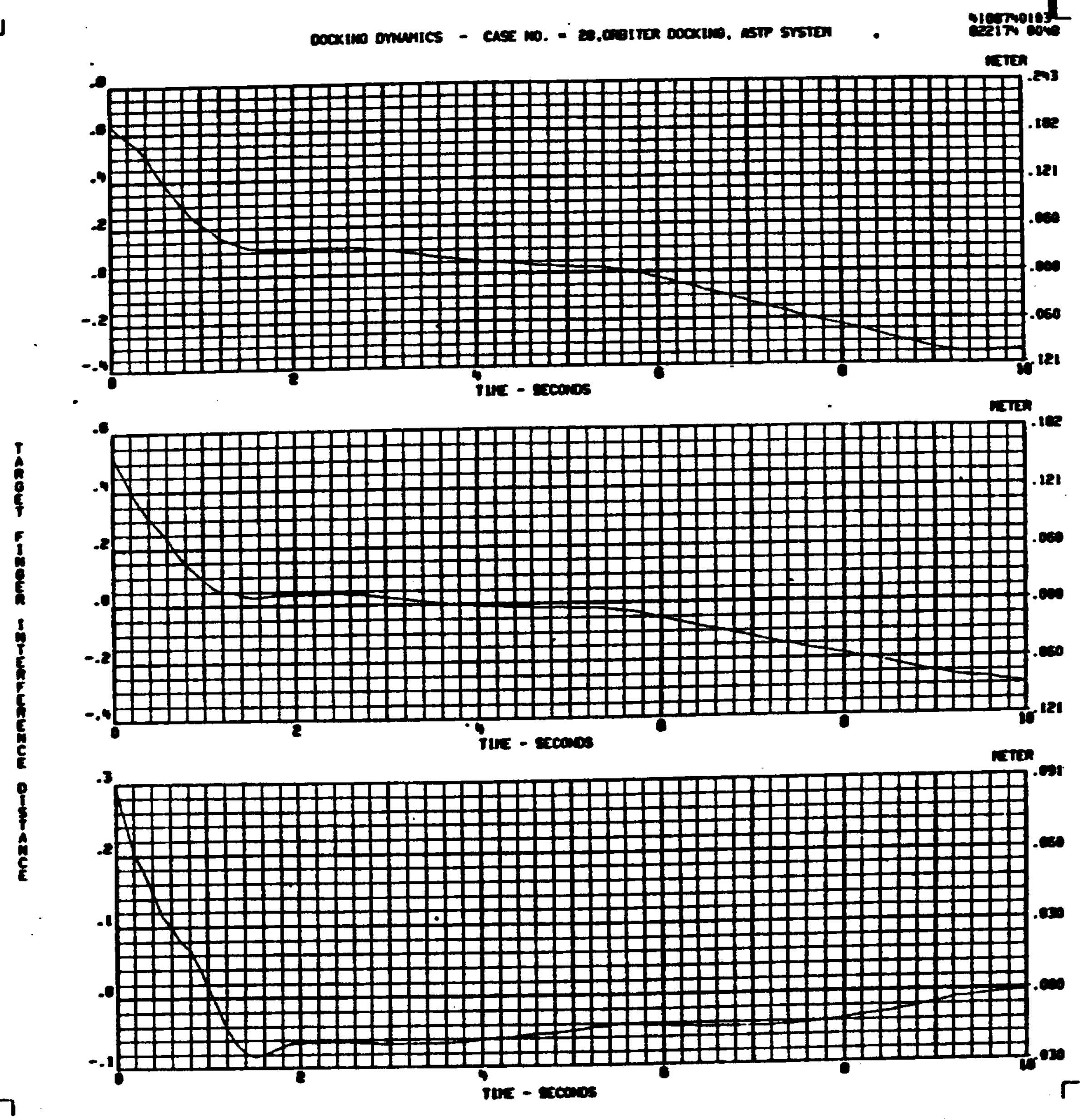
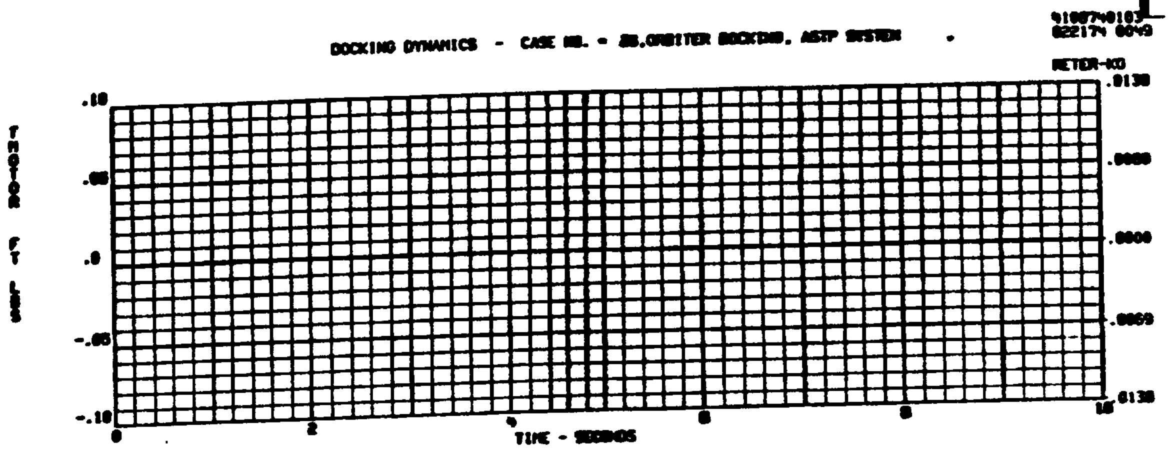
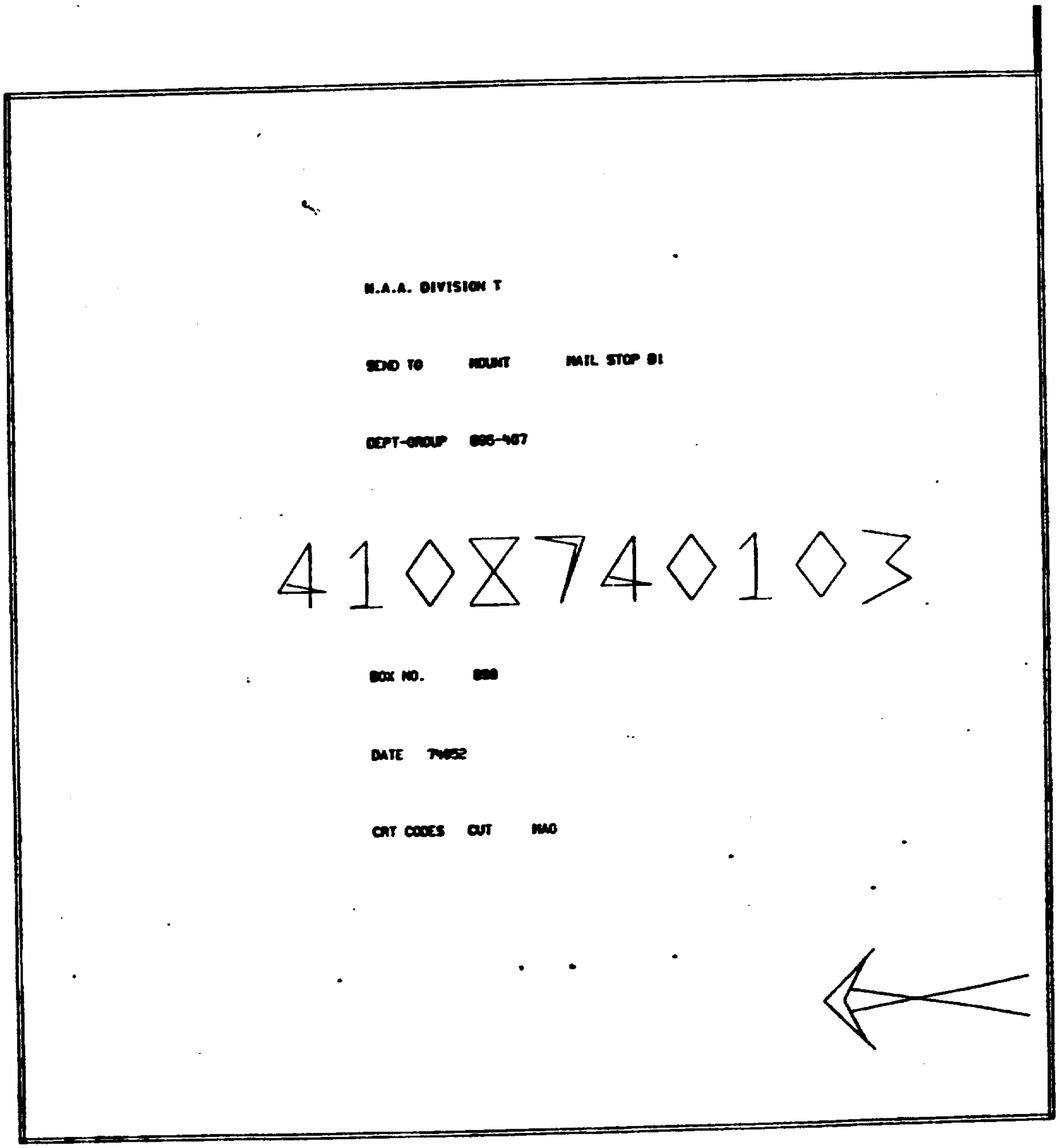


SD 74-CS-0023


DOCKING DYNAMICS - CASE NO. = 28,ORBITER DOCKING, ASTP SYSTEM
TARGET FINGER INTERFERENCE DISTANCE
METER
TIME - SECONDS


DOCKING DYNAMICS
TMOTOR FT LBS
.10
.0
-.10
0
2
4
TIME


N.A.A. DIVISION T
SEND TO MOUNT MAIL STOP 81
DEPT-GROUP 095-407
4108740103
BOX NO. 000
DATE 74052
CRT CODES OUT MAG

PROGRAM FLOW DIAGRAMS

AUTOFLOW CHART SET

RFDO.FLO

05/22/74

CHART TITLE - PROCEDURES

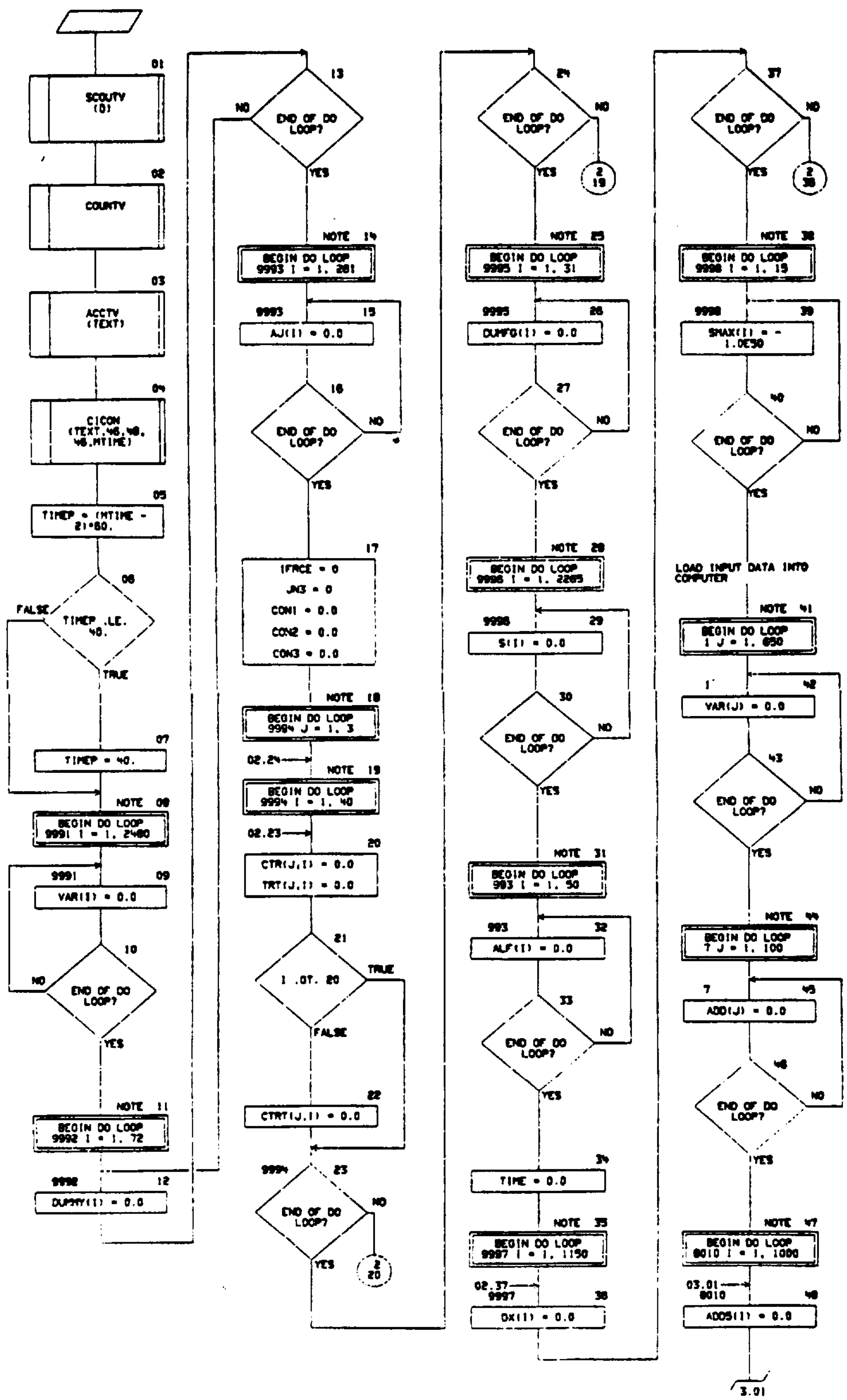


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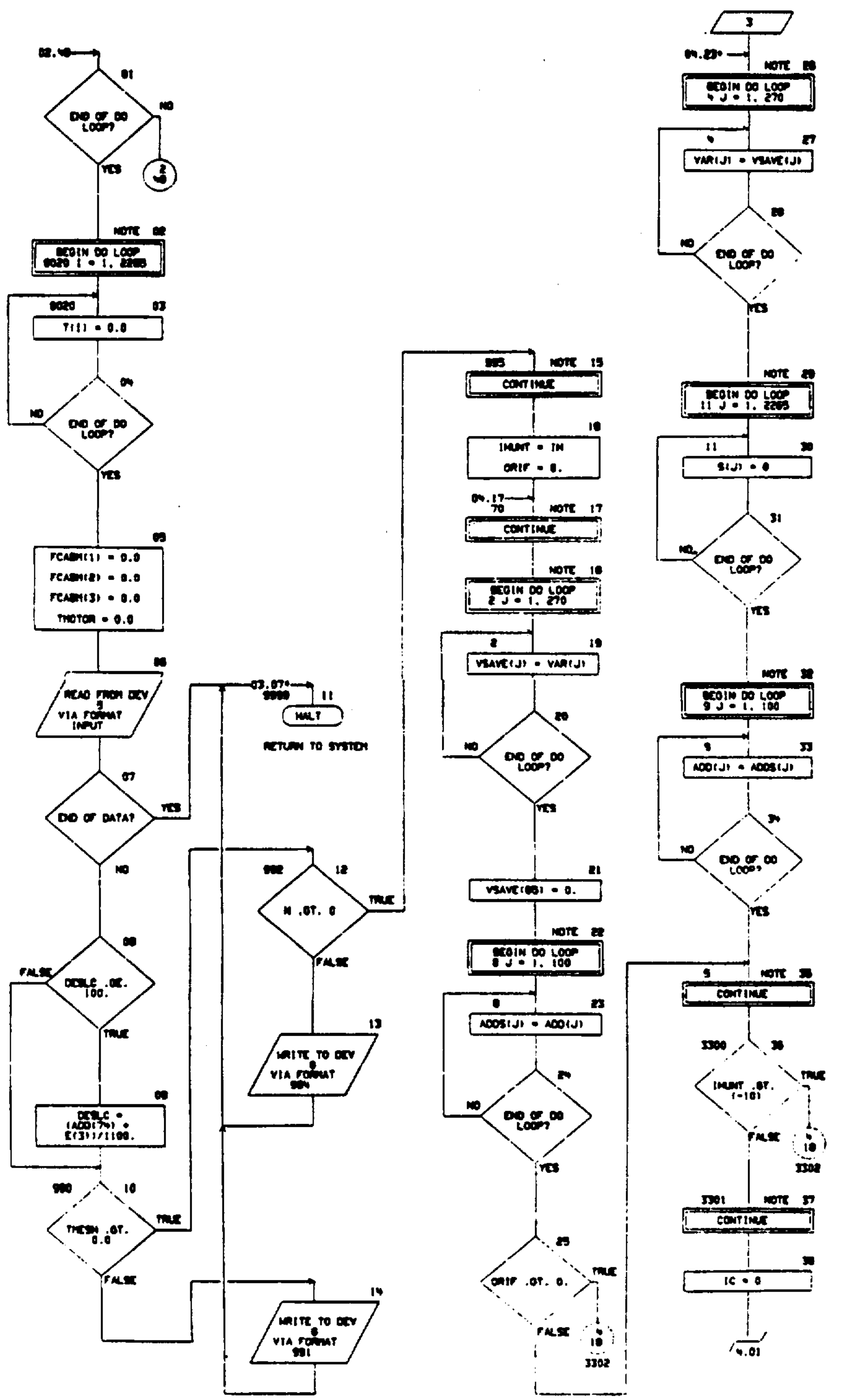
CHART TITLE - PROCEDURES



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SD 74-CS-0023

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CHART TITLE - PROCEDURES

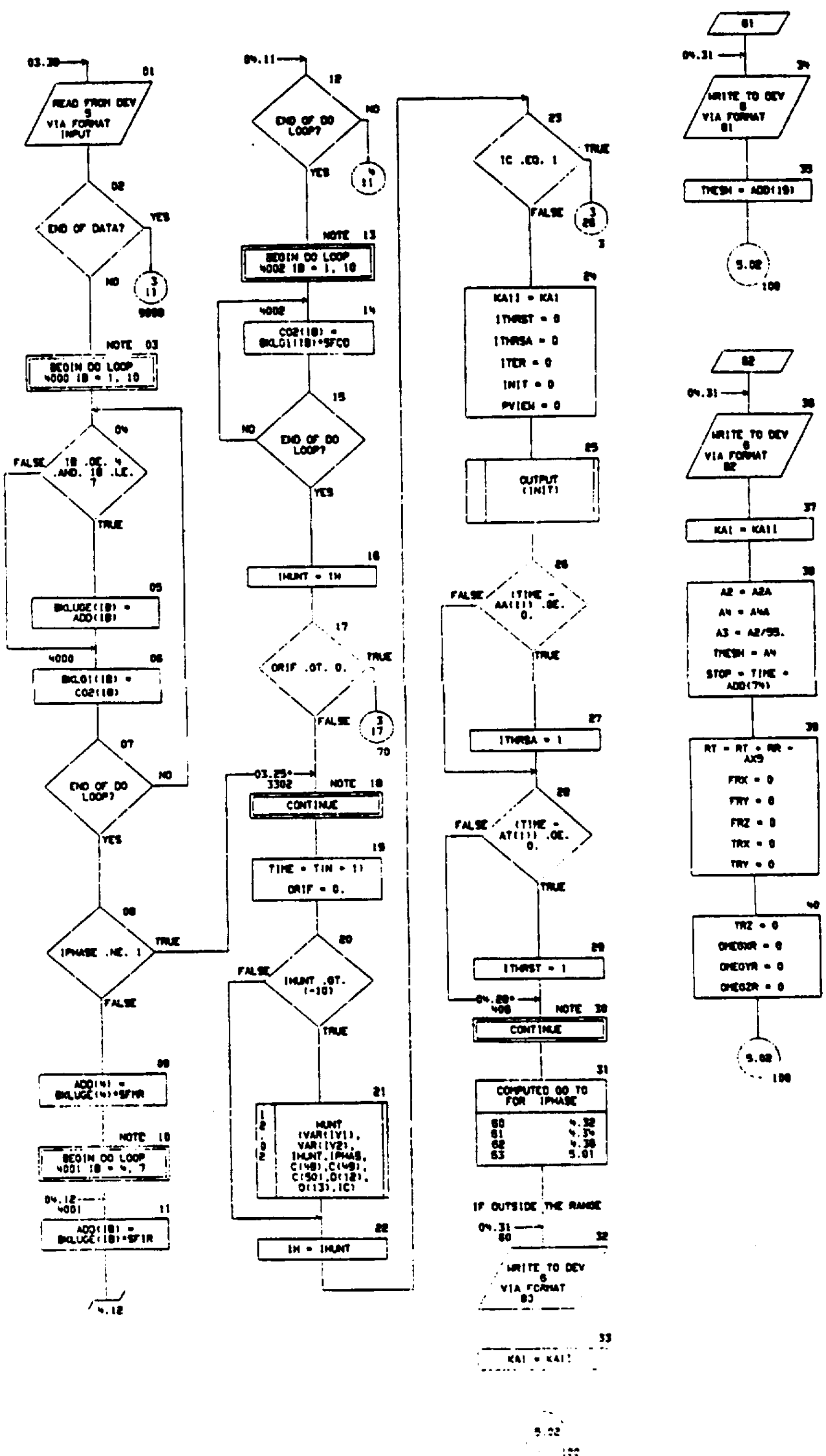

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CHART TITLE - PROCEDURES

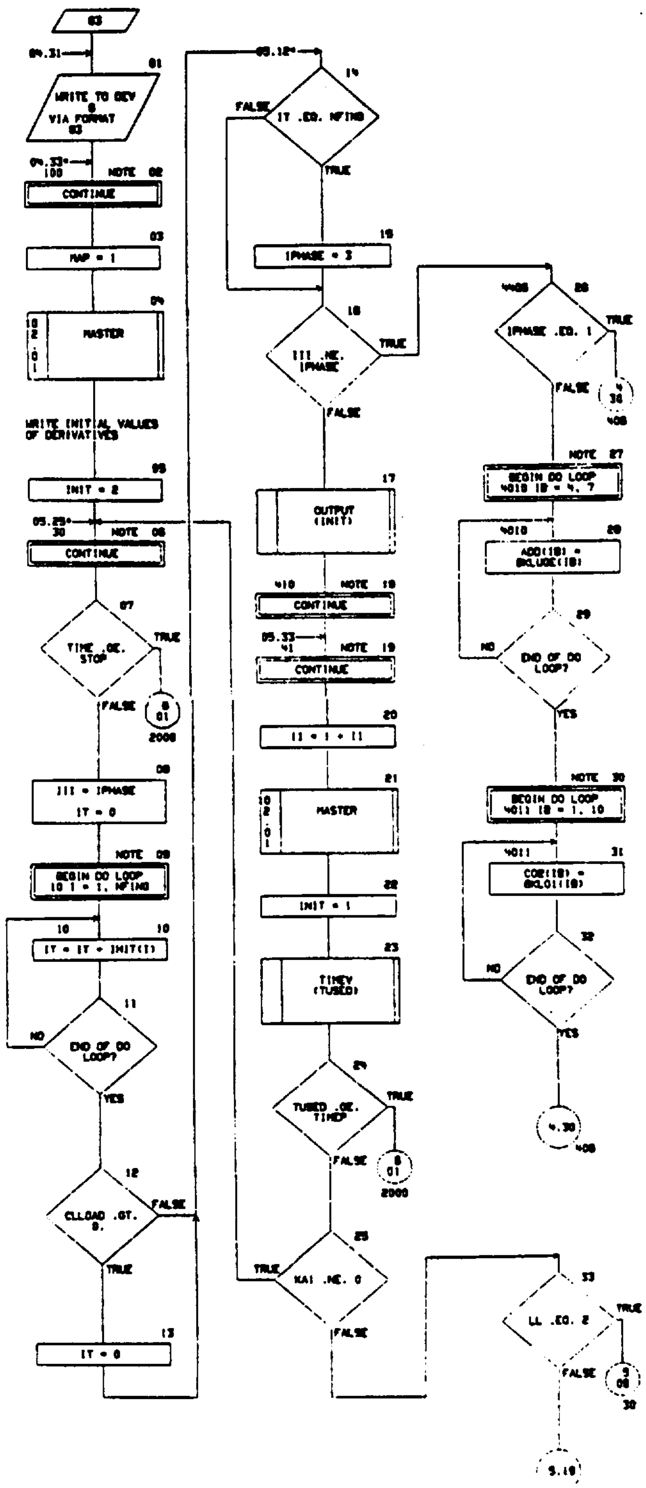

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CHART TITLE - PROCEDURES

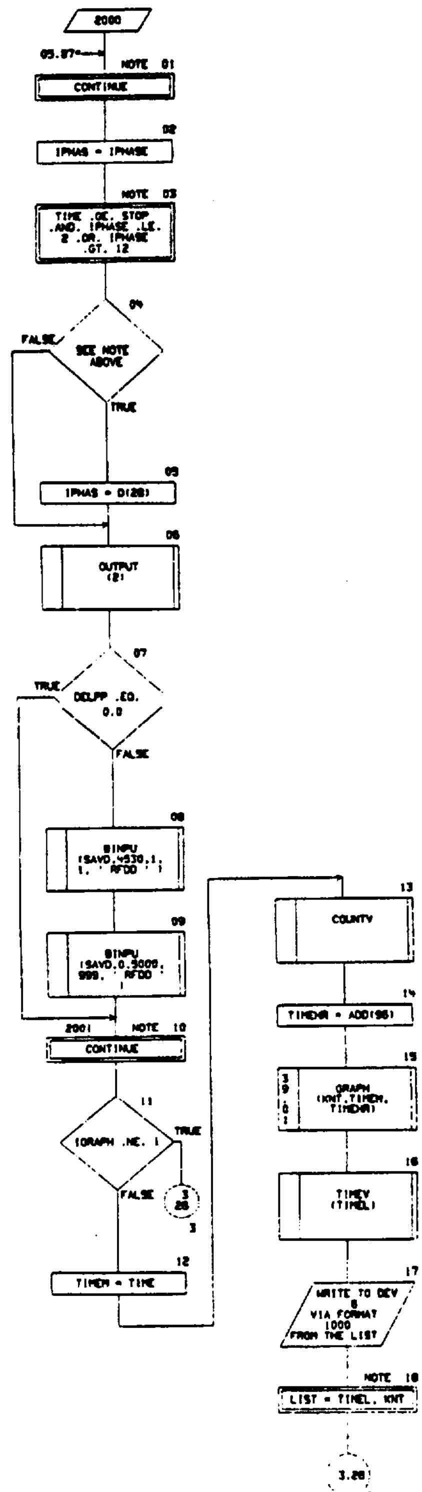

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
      DIMENSION BKLUDE(10),BKLD1(10)
      EQUIVALENCE (SFMR,BKLUDE(1)),(SFIR,BKLUDE(2)),(SFCO,BKLUDE(3))
      DIMENSION VAR(2400),T(2805),A(15),B(15),C(50),D(30),E(15),F(10),
     .        AA(25),AT(30),CO(10),SB(10),VSAVE(270)
     .   S(2805),ADD(100),ADDS(100)
      EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
                (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
                (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
                (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
                (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
                (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
                (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
                (T(29),YTD),(T(30),ZTD)
                ,(DX(18),XPD)
               ,(DX(38),PHRD),(DX(40),OMEXRD),(DX(41),OMEYRD)
               ,(DX(42),OMEZRD)
      COMMON/EFLEX/TIME,DX(150),ADDS(1000)
      DIMENSION DUMMY(1),DUMFO(1)
      EQUIVALENCE (DUMMY(1),GAMA(1)),(DUMFO(1),FO)
      EQUIVALENCE (A(2),XMA),(A(3),XXIA),(A(4),YYIA),(A(5),ZZIA),
                (A(6),XYIA),(A(7),XZIA), (A(8),YZIA),(A(9),OFFJA),
                (A(10),OFFKA),(A(11),RA)
      EQUIVALENCE (B(2),XMT),(B(3),XXIT),(B(4),YYIT),(B(5),ZZIT),
                (B(6),XYIT),(B(7),XZIT),(B(8),YZIT),(B(9),OFFJT),
                (B(10),OFFKT),(B(11),RT)
       ,(C(21),CLLOAD)
       ,(C(1),MATTEN)
       ,(C(47),ISIMPL)
                ,(D(29),IV1),(D(30),IV2)
      EQUIVALENCE (E(2),IPHASE),(E(3),STOP),(E(4),DELPP),(E(5),CASE),
                (E(6),IGRAPH),(E(7),DELP),(E(8),DESLC),(E(9),JN),
                (E(10),ICASE)
      EQUIVALENCE (F(2),THESM),(F(3),N),(F(4),A3),(F(5),A5),(F(6),KA1),
                (F(7),A2),(F(8),A4),(F(9),A7)
                ,(F(1),A2A),(F(10),A4A)
                ,(ADD(1),RR),(ADD(11),AK5),(ADD(8),NFIND),(S(45),INIT(1
       ))
      DIMENSION INIT(20)
      EQUIVALENCE(D(5),ORIF),(D(14),IN)
      COMMON/FORCR/FRX,FRY,FRZ,TRX,TRY,TRZ
      EQUIVALENCE (AA(2),THCOMA),(AA(3),PHCOMA),(AA(4),PSCOMA),
                (AA(5),ARXA),(AA(6),ARYA),(AA(7),ARZA),(AA(8),ADPHA),
                (AA(9),ADTHA),(AA(10),ADPSA),(AA(11),TXA),(AA(12),TYA)
               ,(AA(13),TZA),(AA(14),DBANXA),(AA(15),DBANYA),
                (AA(16),DBANZA),(AA(17),FXA),(AA(18),REACTA),
                (AA(19), BANXA),(AA(20),BANYA),(AA(21),BANZA)
               ,(AA(22),IR)
      EQUIVALENCE (AT(2),DRNOR),(AT(3),DYRX),(AT(4),TRCST),(AT(5),DPX),
                (AT(6),ARXT),(AT(7),ARYT),(AT(8),ARZT),(AT(9),ADPHT),
                (AT(10),ADTHT),(AT(11),ADPST),(AT(12),DBANXT),
                (AT(13),DBANYT),(AT(14),DBANZT),(AT(15),THCONT),
                (AT(16),PHCONT),(AT(17),PSCONT),(AT(18),REACTT),
                (AT(19),BANXT),(AT(20),BANYT),(AT(21),BANZT),
                (AT(22),TXT),(AT(23),TYT),(AT(24),TZT),(AT(25),FXT),
                (AT(26),RMAXT),(AT(27),YMAXT),(AT(28),PMAXT),
                (AT(29),IRCS),(AT(30),IVEH)
       ,(S(31),ITHRSA),(S(32),ITHRST),(S(33),IHOLDA),(S(34),IHOLDT)
      EQUIVALENCE (VAR(1),A(1)),(VAR(16),B(1)),(VAR(31),C(1)),
                (VAR(81),D(1)),(VAR(111),E(1)),(VAR(126),F(1)),
                (VAR(136),AA(1)),(VAR(161),AT(1)),(VAR(191),CO(1)),
                (VAR(201),SB(1)),(VAR(211),T(1))
      COMMON VAR
      COMMON/PP/NAP,LL
```

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
      COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
     ,PROBEA,TLSA,I1,IKA1,THESH1,CONST
      COMMON /LOG/YARM1,YARM2,YARM3,XLCB1,XLCB2,XLCB3
      COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
       GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
       GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
       GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
       GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
       GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
       GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
       GAMP32,GAMP33
     ,GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
      COMMON/ATTACH/AJ(20),AK(20),TJ(20),TK(20),DUM(101)
      COMMON/DVIDA/CON1,CON2,CON3,CTR(3,40),CTRT(3,20)
      COMMON/CALCU/FG,FC,F1,TOR1,FS1,FS2,FS3,FCR1,FCR2,FCR3,ETA1,
       ETA2,ETA3,FRT1A,FRT2A,FRT3A,TLS1,TLS2,TLS3,FRT1B,FRT2B,FRT3B,
       VELB1,VELB2,VELB3,VELP,FRICP,FRC1,FRC2,FRC3,PROBEL
      COMMON/DROGU/ETA,YDC,ZDC
      COMMON/RECAL/S
      COMMON/ION/IONT
      COMMON/ADDNEW/ADD
      COMMON /ADDLF/ ALF(75)
      DIMENSION ABB(10),ORD(10),SS2(10),CO2(10),RPM(15),TOE(15)
      EQUIVALENCE (ALF(01),ABB(1)),(ALF(11),ORD(1)),
                  (ALF(21),SS2(1)),(ALF(31),CO2(1)),
                  (ALF(45),RPM(1)),(ALF(60),TOE(1)),
                  (ALF(41),ITSPO), (ALF(42),JN2),
                  (ALF(43),JN3)
       COMMON/FNOR1/VNOR
       COMMON/TIM/TIMEO
       EQUIVALENCE (MPLOT,E(1)),(IH,D(14)),(IXTRA,ADD(70))
       DOUBLE PRECISION TTL1,TTL2
       COMMON /TITLES/ TTL1(6),TTL2(6)
       COMMON /CA/ VCABR(3,10),VCABB(3,10),CABL(3,10),FCAB(3,10),
                   THOTOR,FCABM(10)
       COMMON /FRCE/ CONTX(9,6),CONRX(9,6),IFRCE
                     ,DELST(10)
       COMMON /STRV/ TRT(3,20)
       COMMON /SAVC/ SAVD(302,15),SMAX(15),IDX(15)
       COMMON /MAX/ TORG(3,8)
       DIMENSION TEXT(15)
       NAMELIST /INPUT/ A,B,C,D,E,F,AA,AT,CO,SS,T,ADD,ADDE,ADDB,IPHASE,
       SFMR,SFIR,SFCO,
        IH,IXTRA,
        IFRCE,ITSPO,JN2,CO2,SS2,ABB,ORD,
        JN3,RPM,TOE,
        TTL1,TTL2,
                    IGRAPH,ICASE,N,KA1,IRCS,IVEH,ISIMPL,JN,MPLOT,
        ITABLE,
        IV1,IV2, NFING,IR,NATTEN
901    FORMAT(1H1/////1H 8X,'THESH IS ZERO')
904    FORMAT(1H1/////1H 8X,'N IS ZERO')
80     FORMAT(' **** PRELATCH FINGER CONTACT ' //)
81     FORMAT(45H *****  NO CONTACT BETWEEN VEHICLES  ******//)
82     FORMAT(' ****  INITIAL LATCH COMPLETED ' //)
83     FORMAT(48H *****  TIP LATCHED -ARM SINGLE CONTACT  *****//)
1000   FORMAT(1H /////1H 8X,'GRAPHING TIME =',E16.8,' SECONDS',10X,
       'IONT=',I4)
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CHART TITLE - FUNCTION ACOS(A)

RING FINGER DOCKING
DYNAMICS (RFDD)
NR VERSION GLYNN
MOUNT 896/408
372-1653

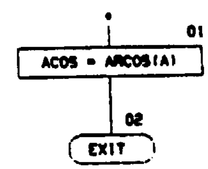

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CHART TITLE - NON-PROCEDURAL STATEMENTS

DIMENSION A(3),B(3)

[redacted]

CHART TITLE - SUBROUTINE HUNT(VX,VR,K,ICOND,VLMIN,VLMAX,VAMIN,DELTA,DELTL,INIT)

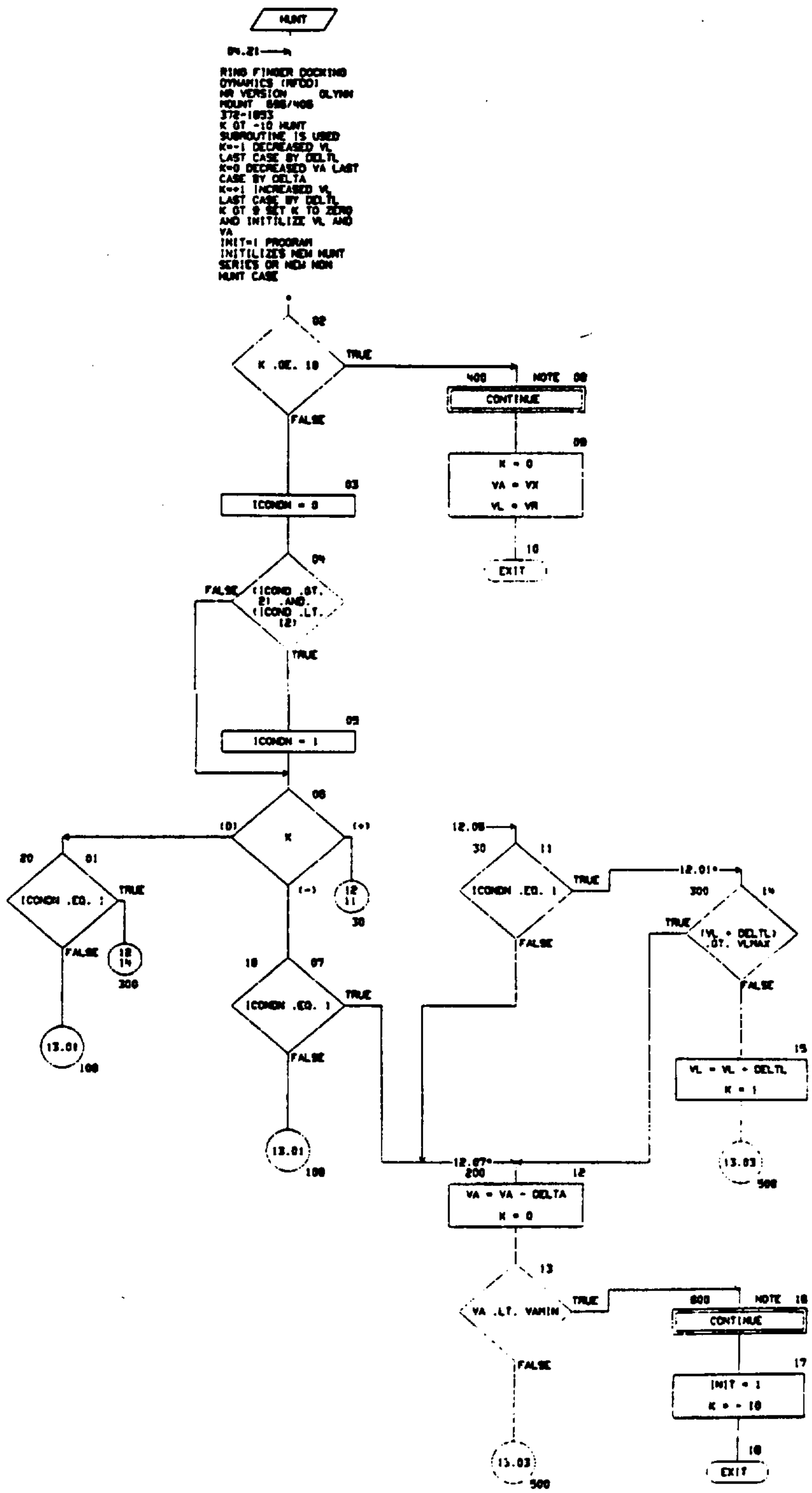

CHART TITLE - SUBROUTINE HUNT(VX,VR,K,ICOND,VLMIN,VLMAX,VAMIN,DELTA,DELTL,INIT)

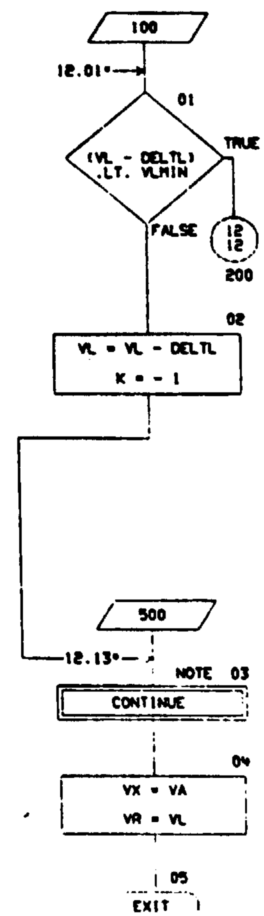

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CHART TITLE - INTRODUCTORY COMMENTS

```
DK1     = KINETIC TERM FOR VISCOUS FLOW IN ORIFICE
RHO     = MASS DENSITY                                   LBS/SEC**2/
XKV     = KINEMATIC VISCOSITY                            IN*IN/SEC
B       = METERING PIN OR RETURN AREA
AC      = ATTENUATOR CYLINDER OR RETURN AREA
DLGHT   = ORIFICE LENGTH
ST      = STROKE POSITION ARRAY                          IN.
ATTND   = ATTENUATOR STROKING VELOCITY (+ FOR COMPRESSION)
AS      = STROKE DISPLACEMENT                            IN.
ASD     = STROKE VELOCITY                                IN./SEC.
JN2   * = NUMBER OF POINTS IN RETURN ORIFICE TABLE
SS2   * = RETURN ORIFICE STROKE
CO2   * = RETURN ORIFICE AREA
SS    * = ATTENUATOR STROKE
CO    * = ATTENUATOR ORIFICE AREA
SP      = SPRING LOAD PLUS FRICTION LOAD                 LBS.
AO      = AREA OF MAIN ORIFICE                           IN.SQ.
APO     = PISTON HEAD ORIFICE AREA                       IN.SQ.
SAPO    = ACCUMULATOR PISTON ORIFICE                     IN.SQ.
AOS     = WIDTH OF ORIFICE                               IN.
RHYD    = HYDRAULIC RADIUS                               IN.
VO      = VELOCITY OF OIL AT MAIN ORIFICE                IN./SEC.
VOS     = VELOCITY OF OIL AT ACCUMULATOR PISTON          IN./SEC.
RE      = REYNOLDS NUMBER AT PISTON HEAD AND MAIN ORIFICE
RES     = REYNOLDS NUMBER AT ACCUMULATOR PISTON
Z       = LENGTH TO WIDTH RATIO OF MAIN ORIFICE
ZS      = LENGTH TO WIDTH RATIO OF ACCUMULATOR PISTON ORIFICE
ZPO     = LENGTH TO WIDTH RATIO OF PISTON HEAD AT ORIFICE
F       = FRACTION OF MAXIMUM PRESSURE RECOVERY DUE
          TO STREAM EXPANSION FOR MAIN ORIFICE
FS      = FRACTION OF MAXIMUM PRESSURE RECOVERY DUE
          TO STREAM EXPANSION FOR ACCUMULATOR PISTON
FPO     = FRACTION OF MAXIMUM PRESSURE RECOVERY DUE
          TO STREAM EXPANSION FOR PISTON HEAD
DC      = DISCHARGE COEFFICIENT FOR MAIN ORIFICE
DCS     = DISCHARGE COEFFICIENT FOR ACCUMULATOR PISTON
DCP     = DISCHARGE COEFFICIENT PISTON HEAD
FP      = FRICTION FACTOR FOR ANNULI OF FINE CLEARANCE
          AND FOR PARALLEL PLATES FOR MAIN ORIFICE
          AND PISTON HEAD
FPS     = FRICTION FACTOR FOR ANNULI AND FINE CLEARANCE
          AND FOR PARALLEL PLATES FOR ACCUMULATOR PISTON
PHA     = TOTAL HYDRAULIC LOAD IN ATTENUATOR             LBS.
PHAI    = HYDRAULIC LOAD IN ATTENUATOR AT PREVIOUS TIME
PHAS    = ACCUMULATOR PISTON HYDRAULIC LOAD              LBS.
PHAP    = HYDRAULIC LOAD AT PISTON HEAD                  LBS.
```

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05/22/74 AUTOFLOW CHART SET - RFDD.FLO RFDD-FLOW PAGE 15

CHART TITLE - SUBROUTINE SHOCK(ST,ATTND,C,FAD,I,FFRICP,FRICP)

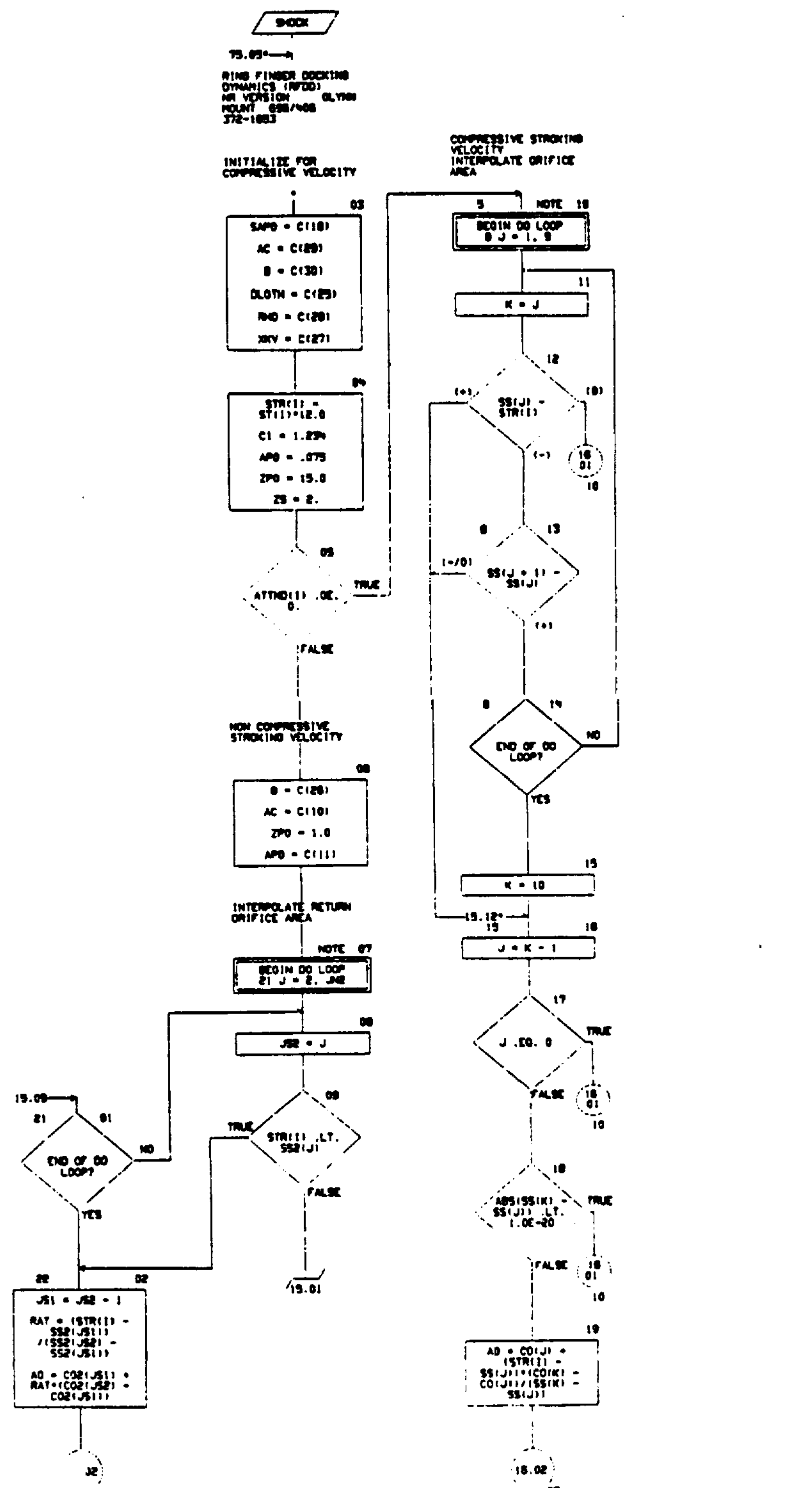

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CHART TITLE - SUBROUTINE SHOCK(ST,ATTRD,C,FAD,I,FFRICP,FRICP)

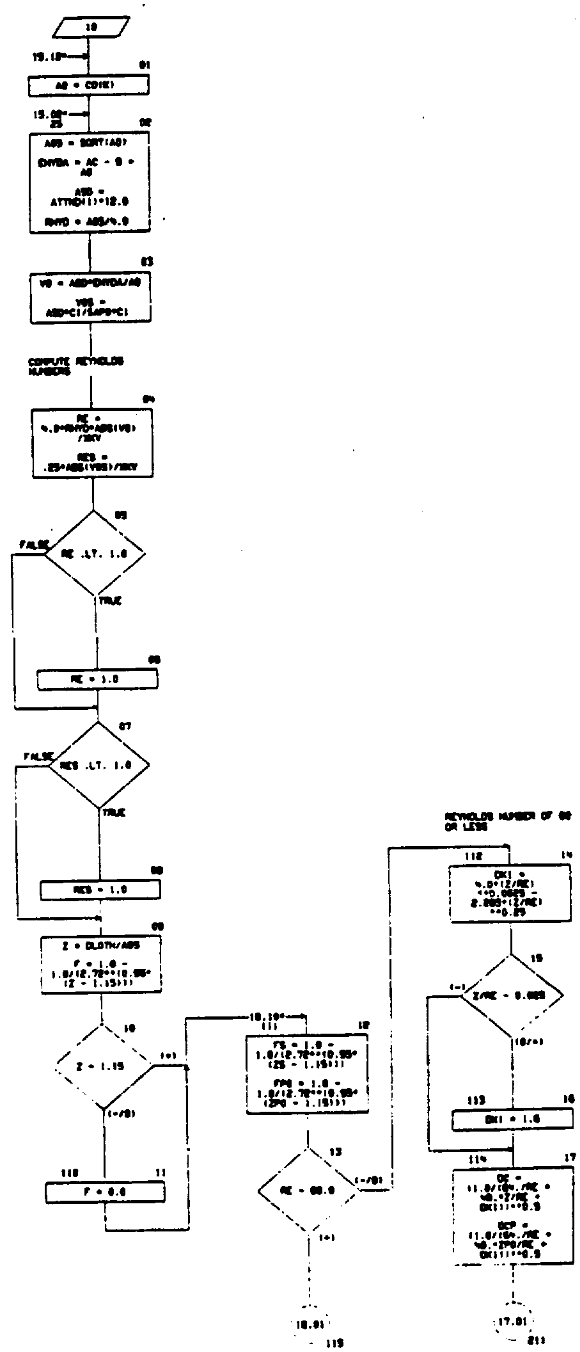

CHART TITLE - SUBROUTINE SHOCK(ST,ATTMO,C,FAO,I,FFRICP,FRICP)

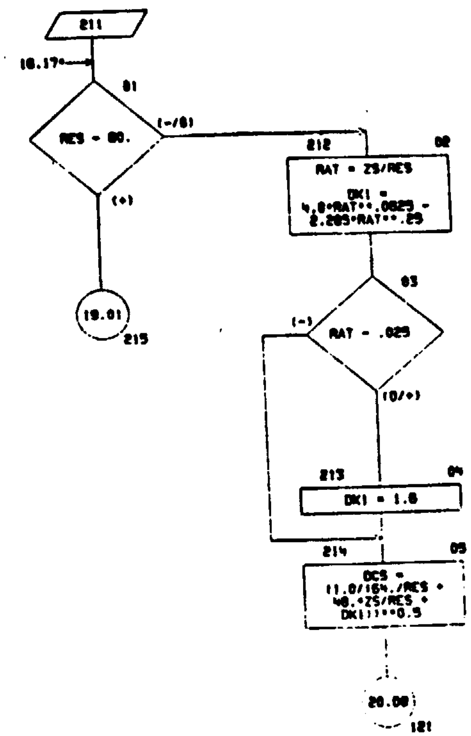

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CHART TITLE - SUBROUTINE SHOCK(ST,ATTND,C,FAD,I,FFRICP,FRICP)

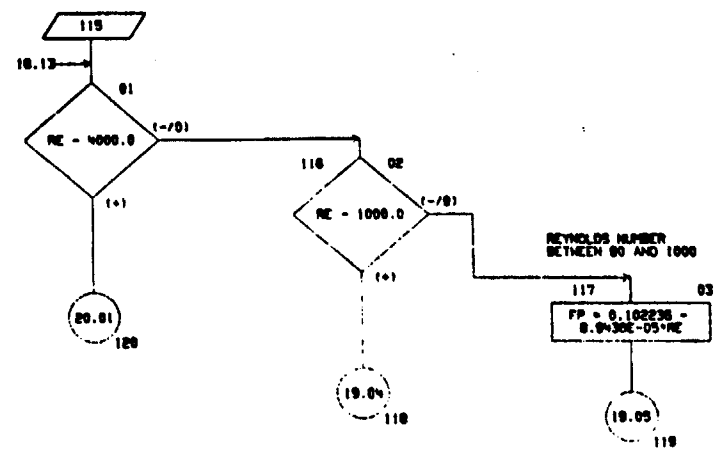

CHART TITLE - SUBROUTINE SHOCK(ST,ATTHD,C,FAD,I,FFRICP,FRICP)

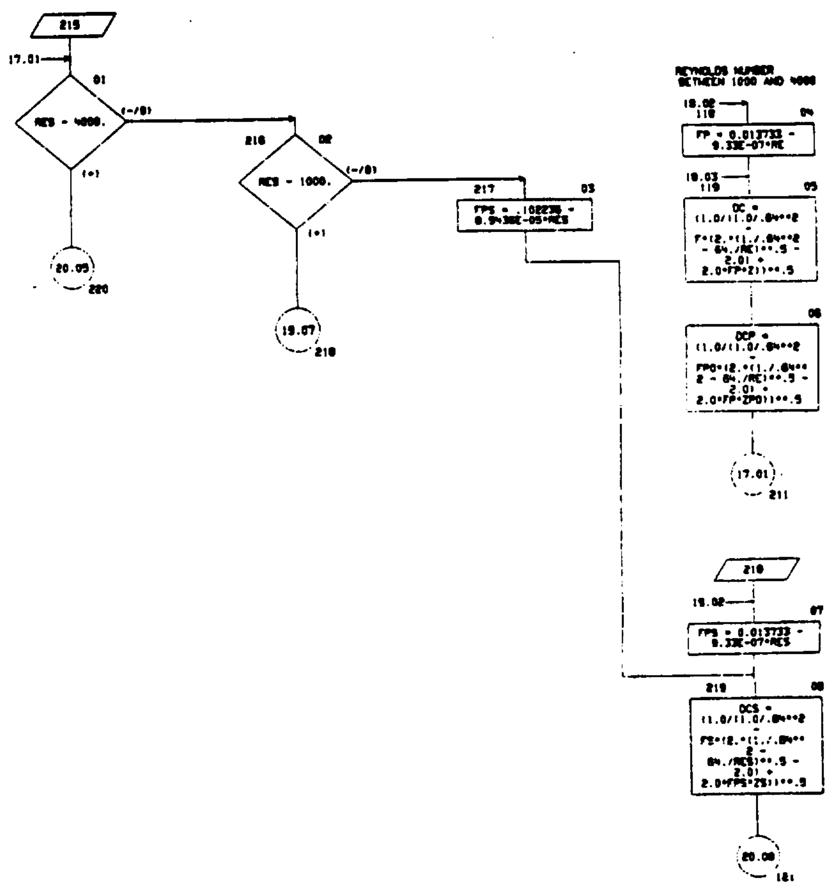

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CHART TITLE - SUBROUTINE SHOCK(ST,ATTHD,C,FAD,I,FFRICP,FRIC?)

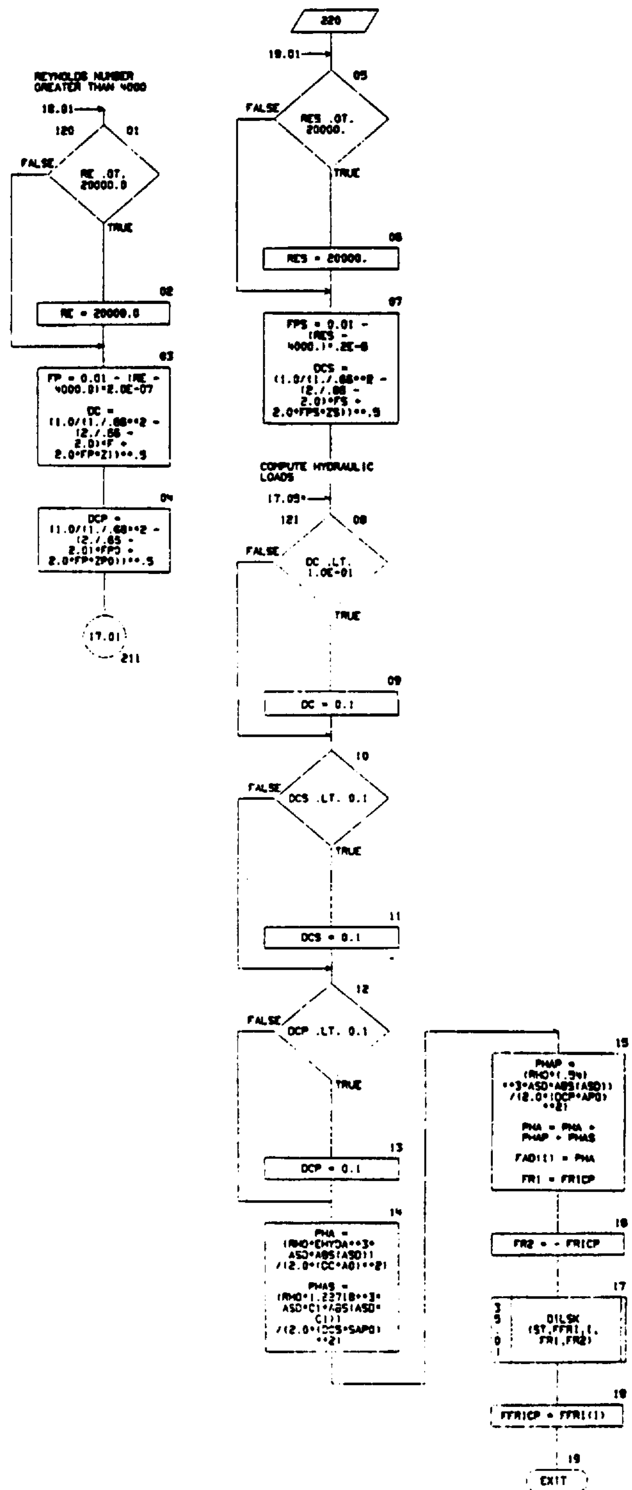

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION STR(20),ATTND(20),C(50),FAD(20),ST(20)
DIMENSION FSKOIL(10),ST1(10)
,FFR1(20)
COMMON/EFLEX/TIME,DX(150),ADD5(1000)
EQUIVALENCE (S(85),ST1(1)),(FSKOIL(1),S(75))
COMMON/RECAL/S(2285)
DIMENSION CO(10),SS(10)
COMMON VAR(2480)
EQUIVALENCE (CO(1),VAR(191)),(SS(1),VAR(201))
COMMON /ADDLF/ ALF(50)
DIMENSION ABB(10),ORD(10),SS2(10),CO2(10)
EQUIVALENCE (ALF(01),ABB(1)),(ALF(11),ORD(1)),
            (ALF(21),SS2(1)),(ALF(31),CO2(1)),
            (ALF(41),ITSPO), (ALF(42),JN2)
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CHART TITLE - SUBROUTINE STROKE(MOUNT,STR,I,C3,CO,SS,JTEST4,JN)

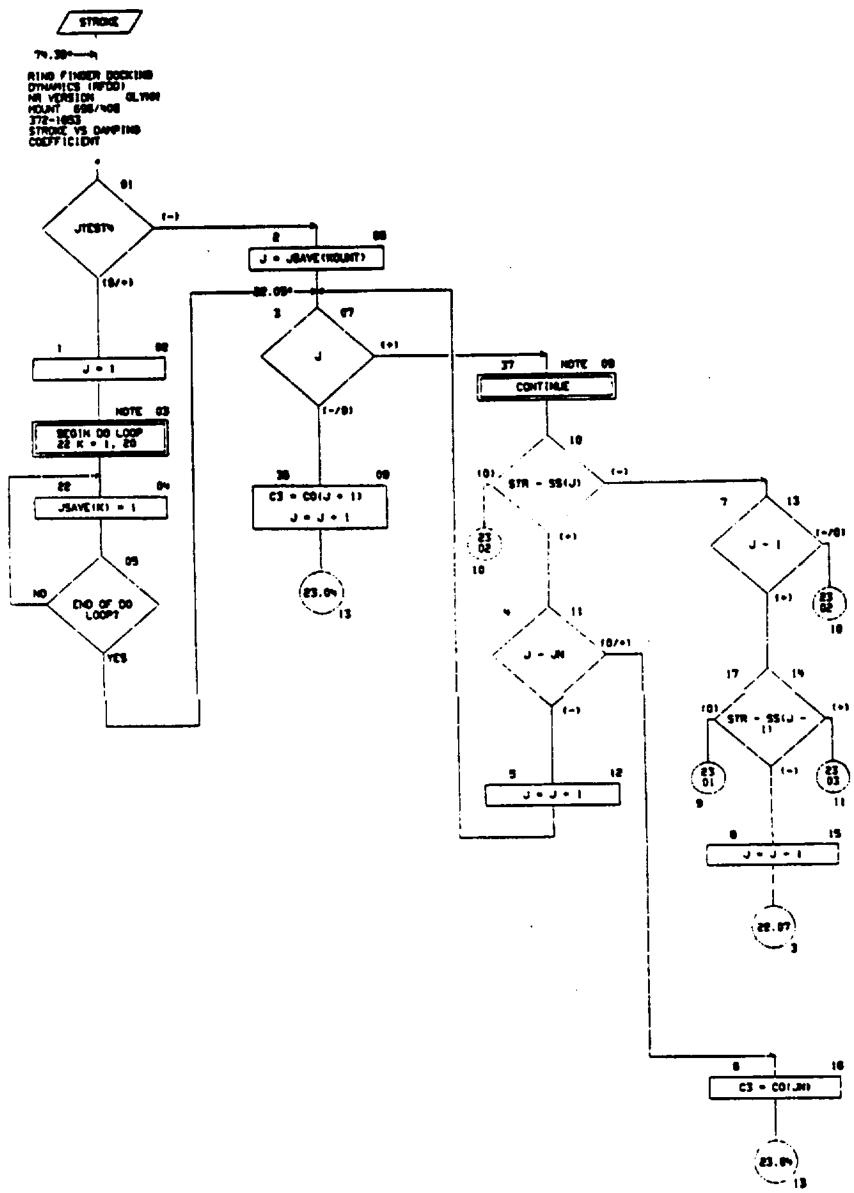

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CHART TITLE - SUBROUTINE STROKE(KOUNT,STR,I,C3,CO,SS,JTEST4,JN)

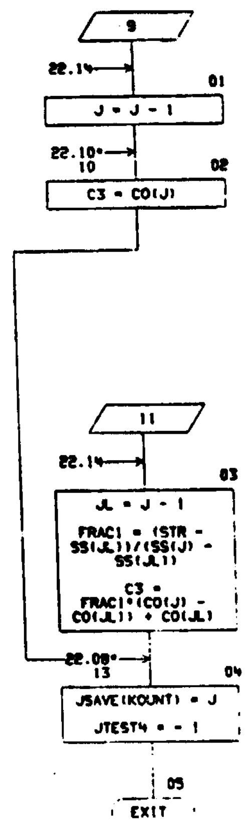

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION CO(10),SS(10)
 . JSAVE(20)
```

CHART TITLE - SUBROUTINE RCSL

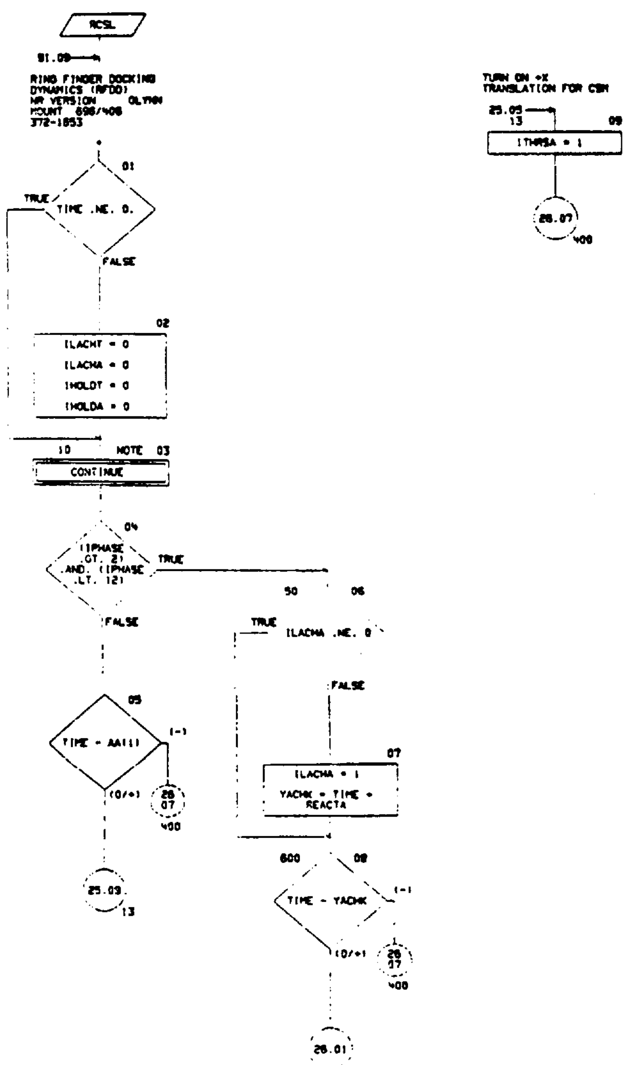

CHART TITLE - SUBROUTINE RCSL

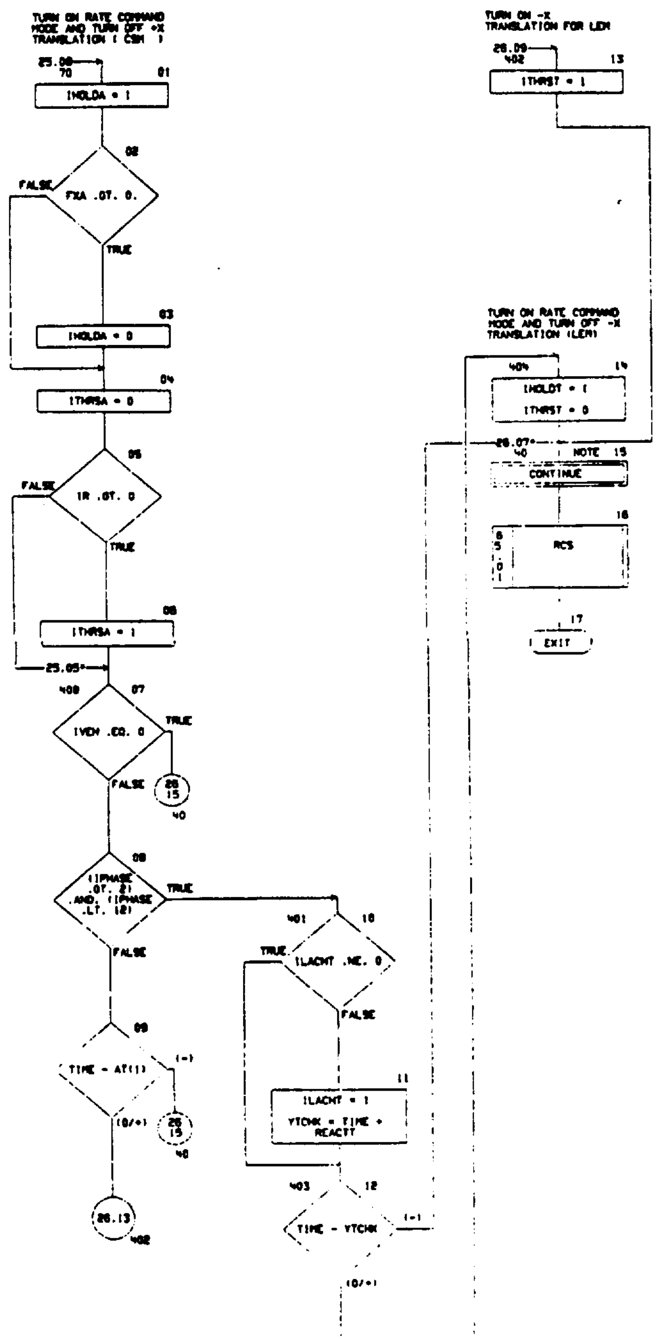

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CHART TITLE - NON-PROCEDURAL STATEMENTS


```
      DIMENSION VAR(2400),T(2885),A(15),B(15),C(50),D(30),E(15),F(10),
     AA(25),AT(30),CO(10),SS(10),YSAVE(270)
     *        S(2285),ADD(100)
      EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
                  (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
                  (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
                  (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
                  (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
                  (T(21),ZP),(T(24),ZD),
                  (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
                  (T(29),YTD),(T(30),ZTD)
      EQUIVALENCE (A(2),XMA),(A(3),XX1A),(A(4),YY1A),(A(5),ZZ1A),
                  (A(6),XY1A),(A(7),XZ1A), (A(8),YZ1A),(A(9),OFFJA),
                  (A(10),OFFKA),(A(11),RA)
      EQUIVALENCE (B(2),XMT),(B(3),XX1T),(B(4),YY1T),(B(5),ZZ1T),
                  (B(6),XY1T),(B(7),XZ1T),(B(8),YZ1T),(B(9),OFFJT),
                  (B(10),OFFKT),(B(11),RT)
      EQUIVALENCE (E(2),IPHASE),(E(3),STOP),(E(4),IPLOT),(E(5),ITABLE),
                  (E(6),IGRAPH),(E(7),DELP),(E(8),DESLC),(E(9),JN),
                  (E(10),ICASE)
      EQUIVALENCE (F(2),THESN),(F(3),N),(F(4),A3),(F(5),A5),(F(6),KA1),
                  (F(7),A2),(F(8),A4),(F(9),A7)
      EQUIVALENCE (AA(2),THCOMA),(AA(3),PHCOMA),(AA(4),PSCOMA),
                  (AA(5),ARXA),(AA(6),ARYA),(AA(7),ARZA),(AA(8),ADPHA),
                  (AA(9),ADTHA),(AA(10),ADPSA),(AA(11),TXA),(AA(12),TYA)
                 ,(AA(13),TZA),(AA(14),DBANXA),(AA(15),DBANYA),
                  (AA(16),DBANZA),(AA(17),FXA),(AA(18),REACTA),
                  (AA(19), BANXA),(AA(20),BANYA),(AA(21),BANZA)
                 ,(AA(22),IR)
      EQUIVALENCE (AT(2),ORNOR),(AT(3),DYRX),(AT(4),TRCST),(AT(5),DPX),
                  (AT(6),ARXT),(AT(7),ARYT),(AT(8),ARZT),(AT(9),ADPHT),
                  (AT(10),ADTHT),(AT(11),ADPST),(AT(12),DBANXT),
                  (AT(13),DBANYT),(AT(14),DBANZT),(AT(15),THCONT),
                  (AT(16),PHCONT),(AT(17),PSCONT),(AT(18),REACTT),
                  (AT(19),BANXT),(AT(20),BANYT),(AT(21),BANZT),
                  (AT(22),TXT),(AT(23),TYT),(AT(24),TZT),(AT(25),FXT),
                  (AT(26),RMAXT),(AT(27),YMAXT),(AT(28),PMAXT),
                  (AT(29),IRCS),(AT(30),IVEH)
     ,(S(31),ITHRSA),(S(32),ITHRST),(S(33),IHOLDA),(S(34),IHOLDT)
      EQUIVALENCE (VAR(1),A(1)),(VAR(16),B(1)),(VAR(31),C(1)),
                  (VAR(81),D(1)),(VAR(111),E(1)),(VAR(126),F(1)),
                  (VAR(136),AA(1)),(VAR(161),AT(1)),(VAR(191),CO(1)),
                  (VAR(201),SS(1)),(VAR(211),T(1))
      COMMON VAR
      COMMON/EFLEX/TIME,DX(150),ADDS(1000)
      COMMON/PP/MAP,LL
      COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
     .PROBEA,TLSA,I1,IKA1,THESH1,CONST
      COMMON /LOO/YARM1,YARM2,YARM3,XLCB1,XLCB2,XLCB3
      COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
       GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
       GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
       GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
       GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
       GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
       GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
       GAMP32,GAMP33
      ,GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
      COMMON/CALCU/FG,FC,F1,TOR1,FS1,FS2,FS3,FCR1,FCR2,FCR3,ETA1,
       ETA2,ETA3,FRT1A,FRT2A,FRT3A,TLS1,TLS2,TLS3,FRT1B,FRT2B,FRT3B,
       VELB1,VELB2,VELB3,VELP,FRICP,FRC1,FRC2,FRC3,PROBEL
      COMMON/CAS/ CASE
      COMMON/DROGU/ETA,YDC,ZDC
```

05/22/74 AUT^^.ON CHART SET - RFDO.FLO RFDO-FLOW PAGE 20

CHART TITLE - NON-PROCEDURAL STATEMENTS

COMMON/RECAL/S
COMMON/KN/KNT
COMMON/ADDNEW/ADD

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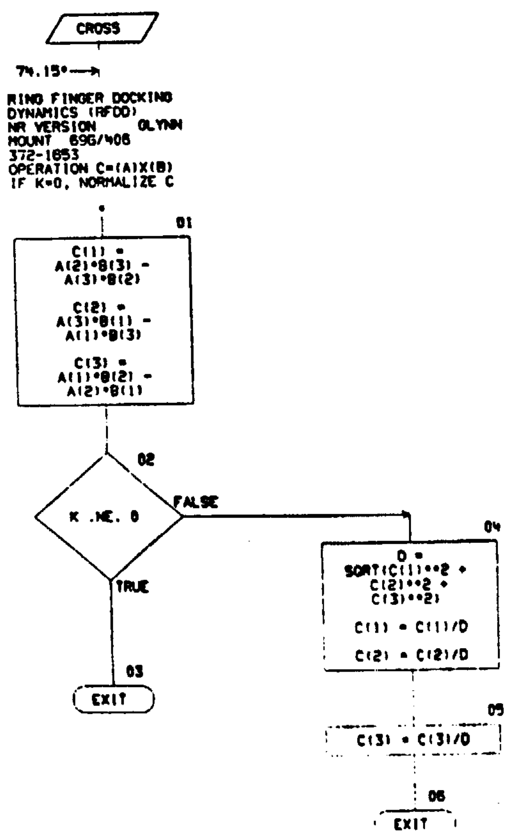
CHART TITLE - SUBROUTINE CROSS(A,B,C,K)



05/22/74 AU' 'OW CHART SET - RFDD.FLO RFDD-FLOW PAGE 30

CHART TITLE - NON-PROCEDURAL STATEMENTS

DIMENSION A(3),B(3),C(3)

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CHART TITLE - SUBROUTINE ADDM(JI,A,N,M,K,B,C,NRD)

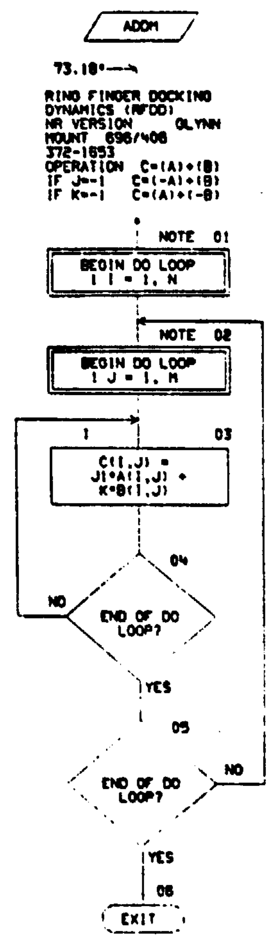
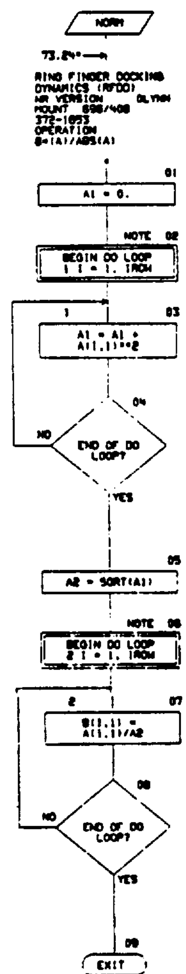


CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION A(NRD,1),B(NRD,1),C(NRD,1)
```

CHART TITLE - SUBROUTINE NORM(A,B,IROW,ID)



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05/22/74 AUT^^ON CHART SET - RFDD.FLO RFDD-FLOW PAGE 34

CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION A(ID,1),B(ID,1)
```

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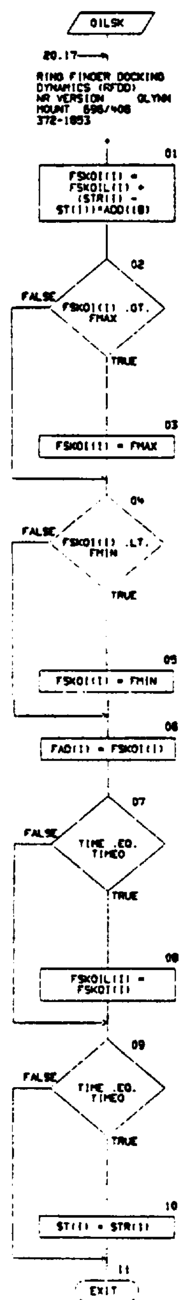
CHART TITLE - SUBROUTINE OILSK(STR,FAD,I,FMAX,FMIN)



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C-3

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION STR(20),FSKOIL(10),ST(10),FAD(20),FSKOI(10)
EQUIVALENCE (S(85),ST(1)),(S(75),FSKOIL(1))
COMMON/RECAL/S(2205)
COMMON/EFLEX/TIME,DX(150),ADD5(1000)
COMMON/TIM/TIMEO
COMMON/ADDNEW/ADD(100)
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CHART TITLE - SUBROUTINE TRAND(TH1,TH2,TH3,DLAM,DLAM1)

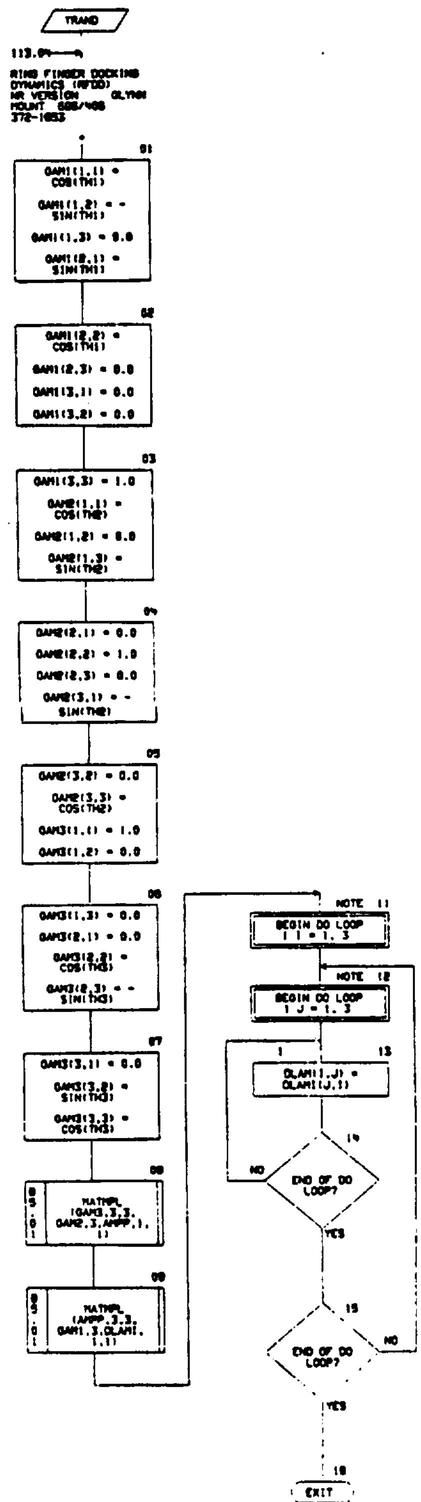

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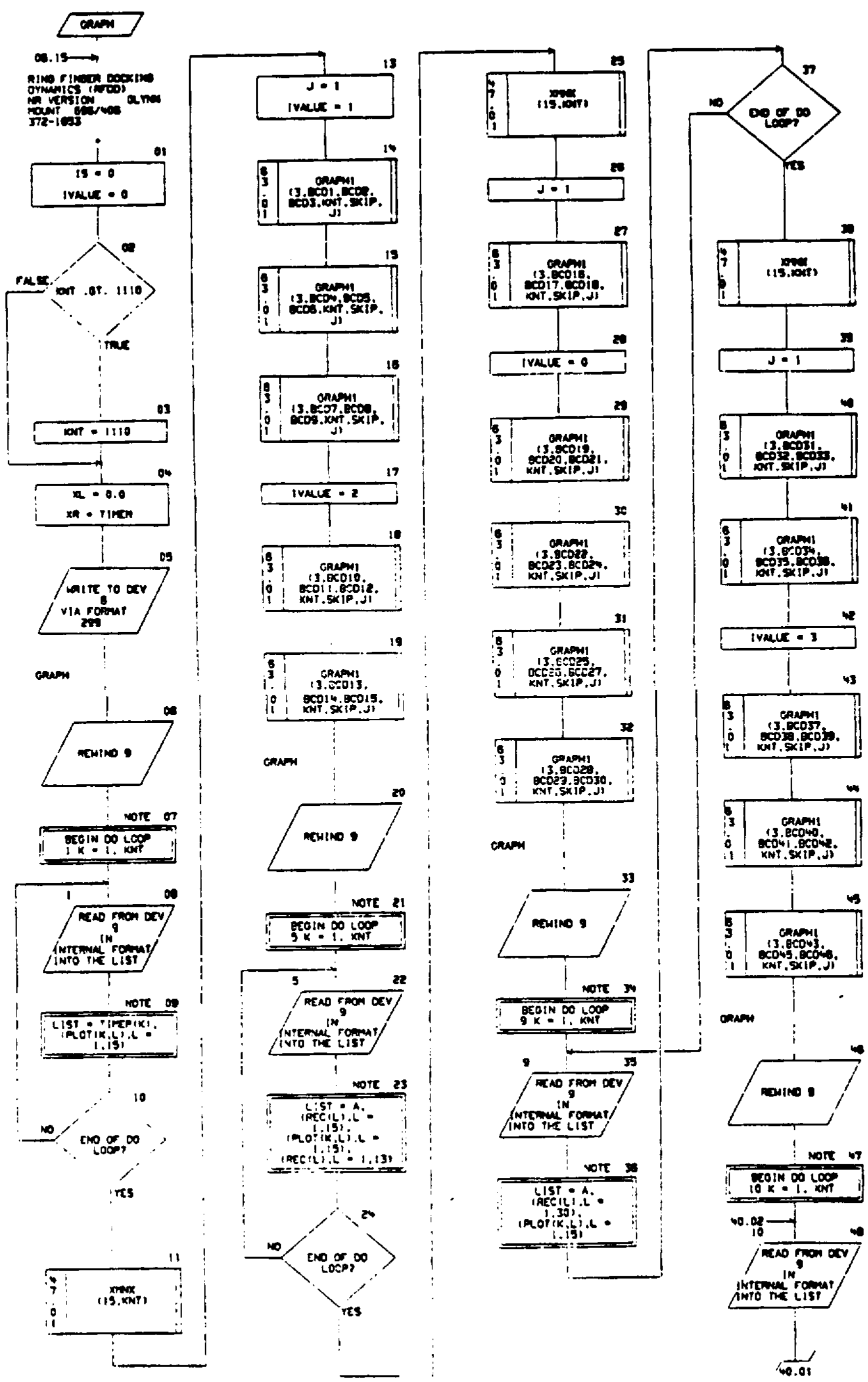
CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION GAM1(3,3),GAM2(3,3),GAM3(3,3),AMPP(3,3),DLAM(3,3),
          DLAMI(3,3)
```

CHART TITLE - SUBROUTINE GRAPH(KNT,TIMEM,TIMEMR)



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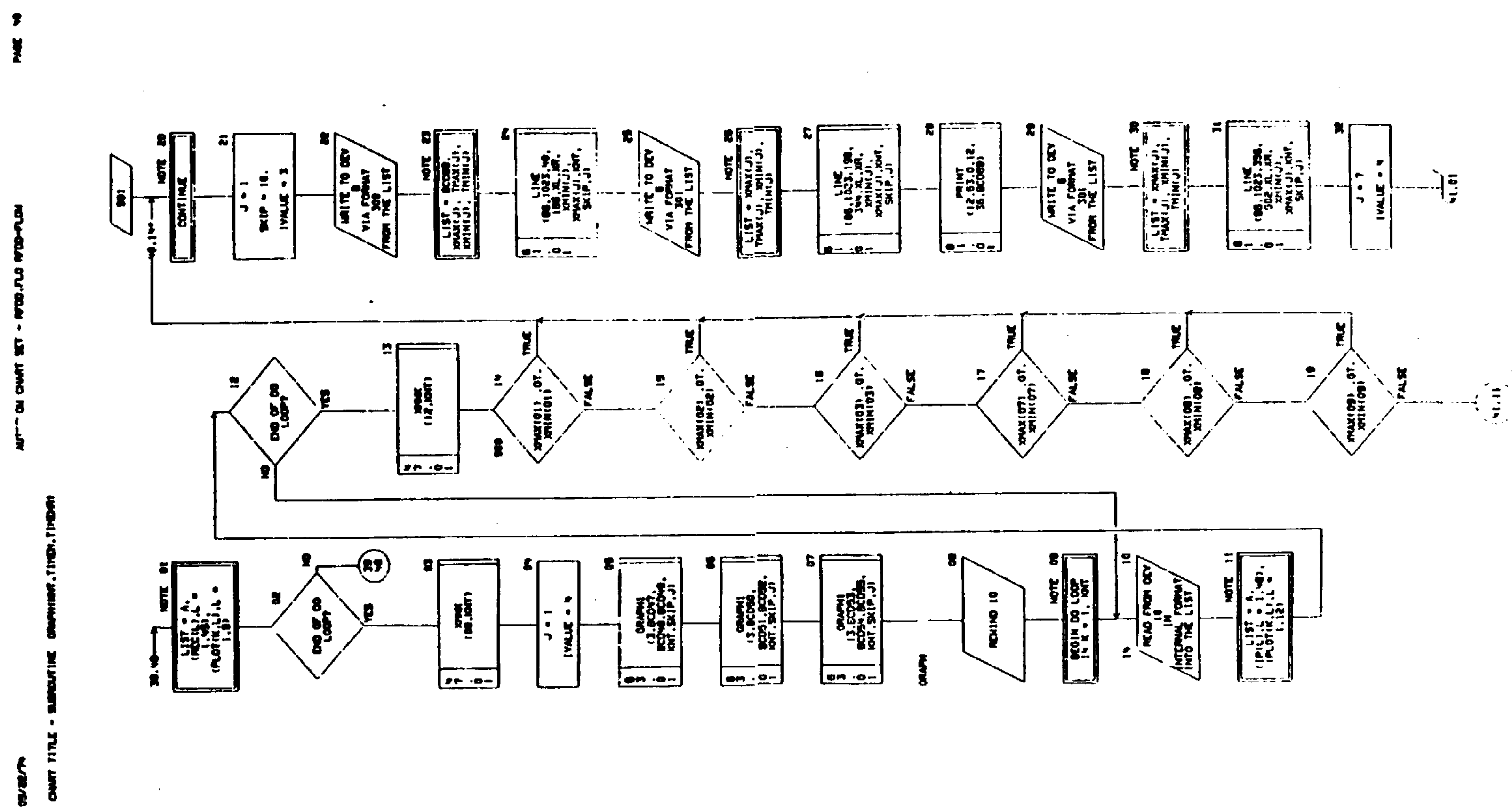

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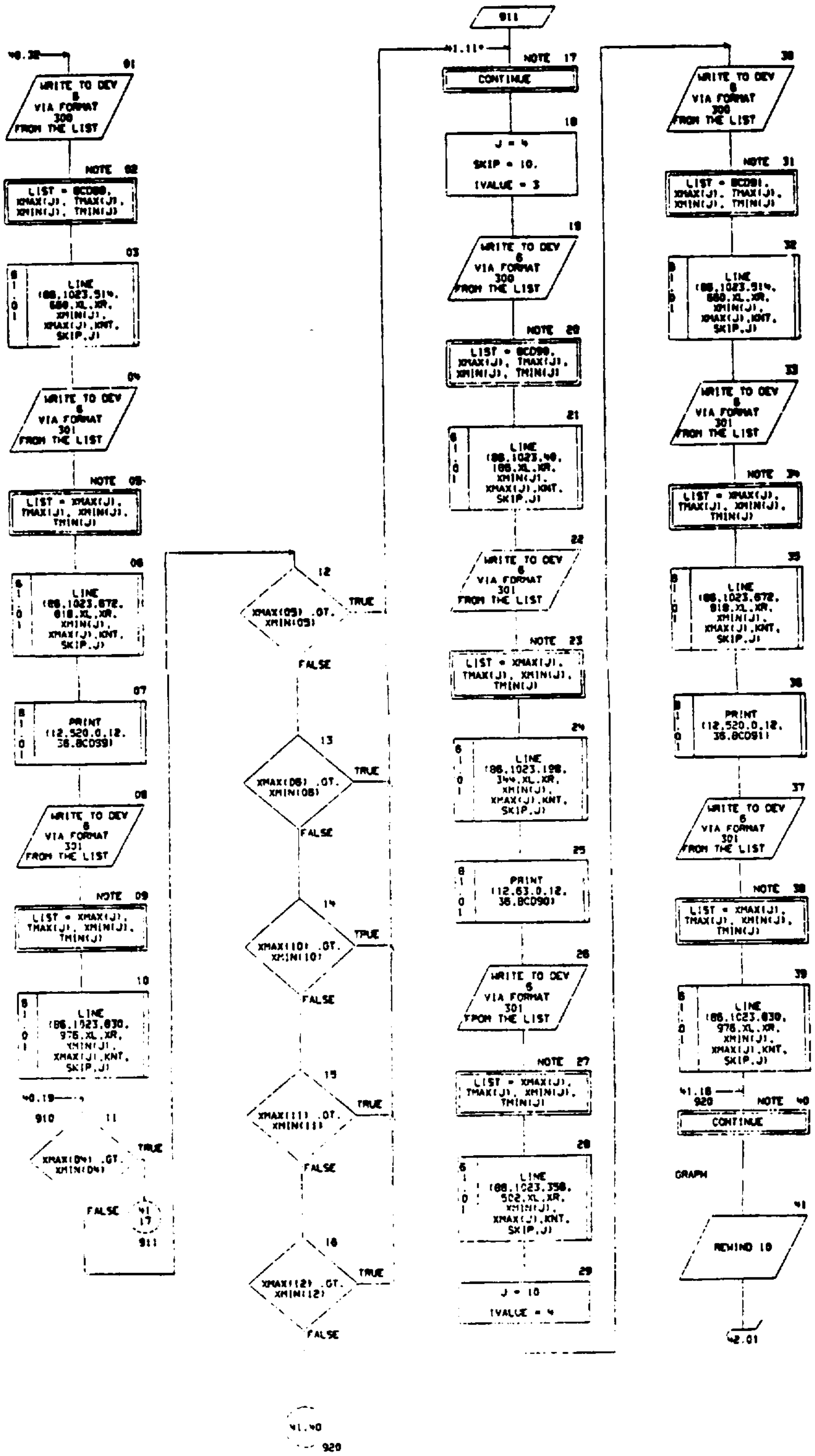
CHART TITLE - SUBROUTINE GRAPH(KNT,TIMEN,TIMEHR)



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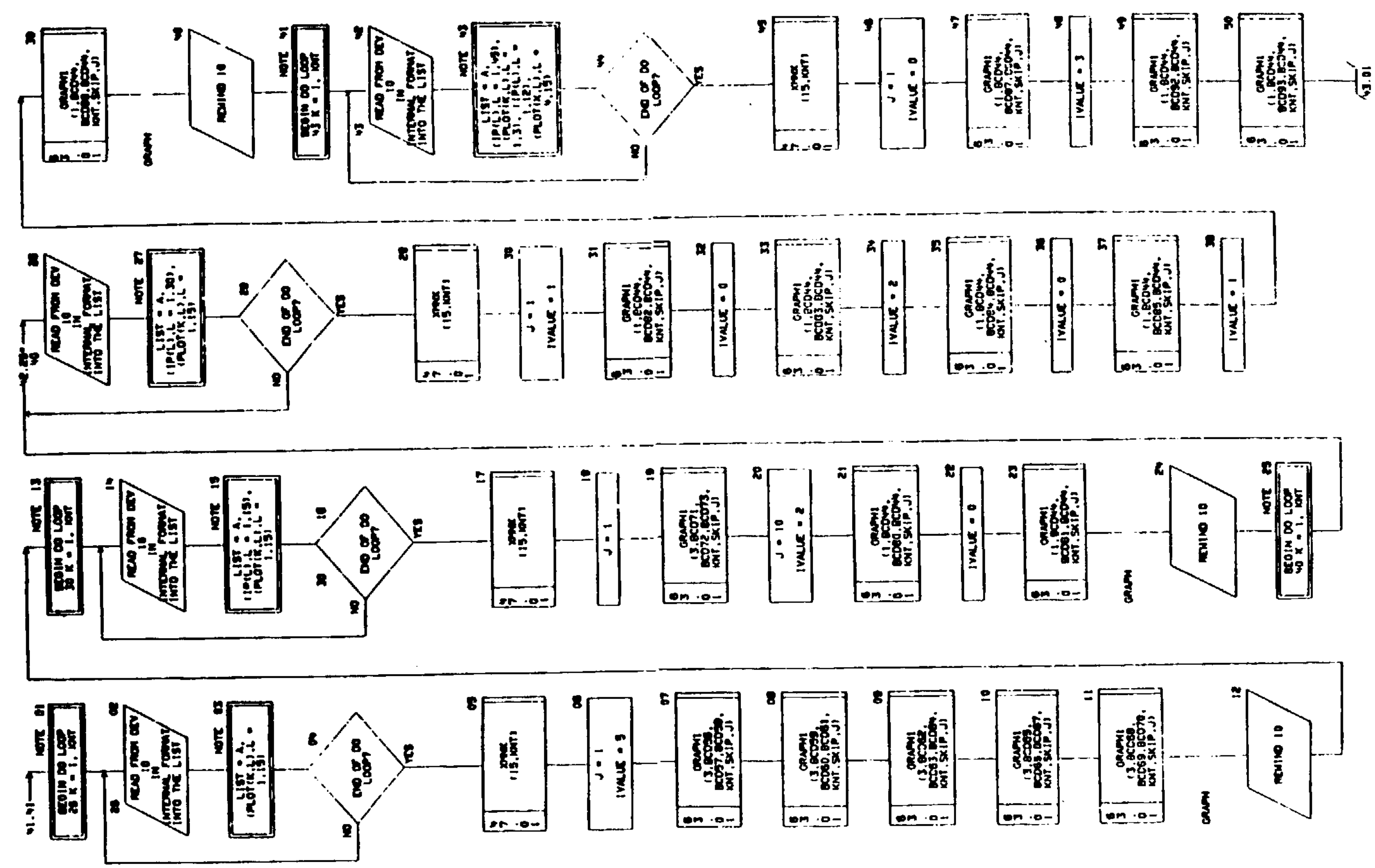

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CHART TITLE - SUBROUTINE GRAPH(KNT,TIMEH,TIMEHR)

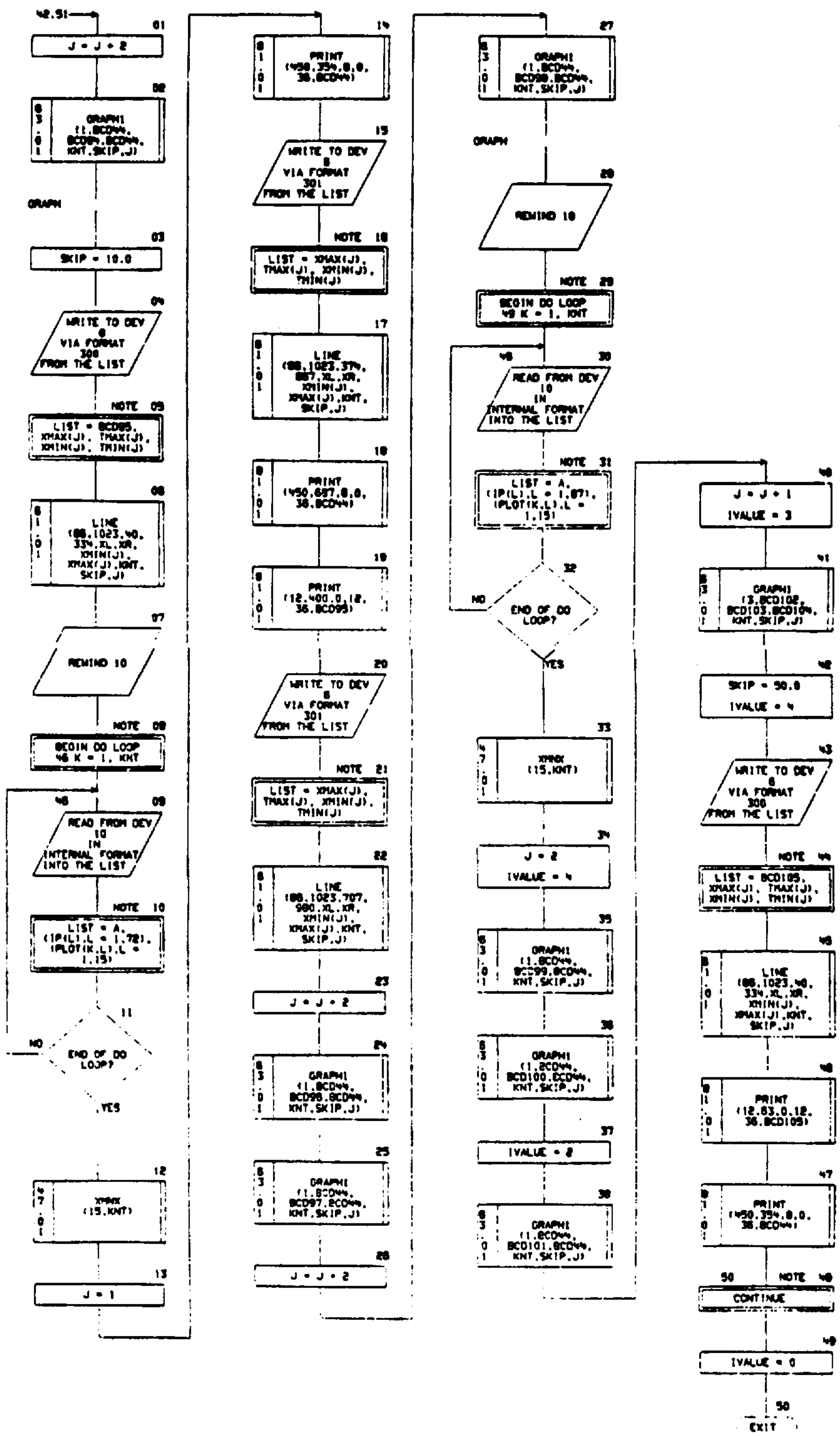

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION PLOT(1110,15),TIMEP(1110),IP(1110)
DIMENSION BCD1(9),BCD2(9),BCD3(9),BCD4(9),BCD5(9),BCD6(9),BCD7(9),
BCD8(9),BCD9(9),BCD10(9),BCD11(9),BCD12(9),BCD13(9),BCD14(9),BCD15
(9),BCD16(9),BCD17(9),BCD18(9),BCD19(9),BCD20(9),BCD21(9),BCD22(9
),BCD23(9),BCD24(9),BCD25(9),BCD26(9),BCD27(9),BCD28(9),BCD29(9),
BCD30(9),BCD31(9),BCD32(9),BCD33(9),BCD34(9),BCD35(9),BCD36(9),
BCD37(9),BCD38(9),BCD39(9),BCD40(9),BCD41(9),BCD42(9),BCD43(9),
 BCD44(9),BCD45(9),BCD46(9)
,BCD47(9),BCD48(9),BCD49(9),BCD50(9),BCD51(9),BCD52(9),
 BCD53(9),BCD54(9),BCD55(9),BCD56(9),BCD57(9),BCD58(9)
,BCD59(9),BCD60(9),BCD61(9),BCD62(9),BCD63(9),BCD64(9),BCD65(9)
DIMENSION
 BCD66(9),BCD67(9),BCD68(9),BCD69(9),BCD70(9),BCD71(9),BCD72(9)
,BCD73(9),BCD74(9),BCD75(9),BCD76(9),BCD77(9),BCD78(9),BCD79(9)
,BCD80(9),BCD81(9),BCD82(9),BCD83(9),BCD84(9),BCD85(9),BCD86(9)
,BCD87(9),BCD88(9),BCD89(9),BCD90(9),BCD91(9),BCD92(9),BCD93(9)
,BCD94(9),BCD95(9),BCD96(9),BCD97(9),BCD98(9),BCD99(9),BCD100(9)
,BCD101(9),BCD102(9),BCD103(9),BCD104(9),BCD105(9)
COMMON/GRAP/PLOT,TIMEP,IP,IS
DIMENSION REC(43),XMAX(43),XMIN(43),TMAX(15),TMIN(15)
COMMON /GRAPHX/ XL,XR,XMIN,XMAX,TMIN,TMAX
COMMON /COS/ IVALUE
DATA BCD1/30H  XAD   FT/SEC                    /
DATA BCD2/30H  YAD   FT/SEC                    /
DATA BCD3/30H  ZAD   FT/SEC                    /
DATA BCD4/30H  XTD   FT/SEC                    /
DATA BCD5/30H  YTD   FT/SEC                    /
DATA BCD6/30H  ZTD   FT/SEC                    /
DATA BCD7/30H  XRD   FT/SEC                    /
DATA BCD8/30H  YRD   FT/SEC                    /
DATA BCD9/30H  ZRD   FT/SEC                    /
DATA BCD10/30H  XA    FT                        /
DATA BCD11/30H  YA    FT                        /
DATA BCD12/30H  ZA    FT                        /
DATA BCD13/30H  XT    FT                        /
DATA BCD14/30H  YT    FT                        /
DATA BCD15/30H  ZT    FT                        /
DATA BCD16/30H  XR    FT                        /
DATA BCD17/30H  YR    FT                        /
DATA BCD18/30H  ZR    FT                        /
DATA BCD19/30H  OMEGXA  DEG/SEC                 /
DATA BCD20/30H  OMEGYA  DEG/SEC                 /
DATA BCD21/30H  OMEGZA  DEG/SEC                 /
DATA BCD22/30H  OMEGXT  DEG/SEC                 /
DATA BCD23/30H  OMEGYT  DEG/SEC                 /
DATA BCD24/30H  OMEGZT  DEG/SEC                 /
DATA BCD25/30H  OMEGXR  DEG/SEC                 /
DATA BCD26/30H  OMEGYR  DEG/SEC                 /
DATA BCD27/30H  OMEGZR  DEG/SEC                 /
DATA BCD28/30H  PHA   DEG                       /
DATA BCD29/30H  THA   DEG                       /
DATA BCD30/30H  PSA   DEG                       /
DATA BCD31/30H  PHT   DEG                       /
DATA BCD32/30H  THT   DEG                       /
DATA BCD33/30H  PST   DEG                       /
DATA BCD34/30H  PHR   DEG                       /
DATA BCD35/30H  THR   DEG                       /
DATA BCD36/30H PSR   DEG                         /
DATA BCD37/30H FSUMAX   LBS                      /
DATA BCD38/30H FSUMAY   LBS                      /
DATA BCD39/30H FSUMAZ   LBS                      /
DATA BCD40/30H FSUMTX   LBS                      /
DATA BCD41/30H FSUMTY   LBS                      /
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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DATA BCD42/30H FSUMTZ   LBS                       /
DATA BCD43/30H FSUMRX   LBS                       /
DATA BCD44 / 4H TIM,4HE - ,4HSECO,4HNDS ,5*1H  /
DATA BCD45/30H FSUMRY   LBS                       /
DATA BCD46/30H FSUMRZ   LBS                       /
DATA BCD47/30H TSUMAX   FT LBS                    /
DATA BCD48/30H TSUMAY   FT LBS                    /
DATA BCD49/30H TSUMAZ   FT LBS                    /
DATA BCD50/30H TSUMTX   FT LBS                    /
DATA BCD51/30H TSUMTY   FT LBS                    /
DATA BCD52/30H TSUMTZ   FT LBS                    /
DATA BCD53/30H TSUMRX   FT LBS                    /
DATA BCD54/30H TSUMRY   FT LBS                    /
DATA BCD55/30H TSUMRZ   FT LBS                    /
DATA BCD56/30H FORCE ATTEN 1   LBS                /
DATA BCD57/30H STROKE ATTEN 1   FT                /
DATA BCD58/30H VELOCITY ATTEN 1   FT/SEC          /
DATA BCD59/30H FORCE ATTEN 2   LBS                /
DATA BCD60/30H STROKE ATTEN 2   FT                /
DATA BCD61/30H VELOCITY ATTEN 2   FT/SEC          /
DATA BCD62/30H FORCE ATTEN 3   LBS                /
DATA BCD63/30H STROKE ATTEN 3   FT                /
DATA BCD64/30H VELOCITY ATTEN 3   FT/SEC          /
DATA BCD65/30H FORCE ATTEN 4   LBS                /
DATA BCD66/30H STROKE ATTEN 4   FT                /
DATA BCD67/30H VELOCITY ATTEN 4   FT/SEC          /
DATA BCD68/30H FORCE ATTEN 5   LBS                /
DATA BCD69/30H STROKE ATTEN 5   FT                /
DATA BCD70/30H VELOCITY ATTEN 5   FT/SEC          /
DATA BCD71/30H FORCE ATTEN 6   LBS                /
DATA BCD72/30H STROKE ATTEN 6   FT                /
DATA BCD73/30H VELOCITY ATTEN 6   FT/SEC          /
DATA BCD74 / 9*1H  /
DATA BCD75 / 9*1H  /
DATA BCD76 / 9*1H  /
DATA BCD77 / 9*1H  /
DATA BCD78 / 9*1H  /
DATA BCD79 / 9*1H  /
DATA BCD80/30H RMTTA  X Y Z   FT                  /
DATA BCD81/30H AMRTA  X Y Z   DEG                 /
DATA BCD82/30H VMRTA  X Y Z   FT/SEC              /
DATA BCD83/30H OMRTA  X Y Z   DEG/SEC             /
DATA BCD84/30H RMRTT  X Y Z   FT                  /
DATA BCD85/30H AMRTT  X Y Z   DEG                 /
DATA BCD86/30H VMRTT  X Y Z   FT/SEC              /
DATA BCD87/30H OMRTT  X Y Z   DEO/SEC             /
DATA BCD88/30H RCS FORCE X Y Z  ACTIVE VEHICLE    /
DATA BCD89/30H RCS TORQUE X Y Z  ACTIVE VEHICLE   /
DATA BCD90/30H RCS FORCES X Y Z  TARGET VEHICLE   /
DATA BCD91/30H RCS TORQUE X Y Z  TARGET VEHICLE   /
DATA BCD92 / 4H FOR,4HCE B,4HETWE,4HEN F,4HINGE,4HRS 1,
             4H-3  .2*1H  /
DATA BCD93 / 4H FOR,4HCE B,4HETWE,4HEN F,4HINGE,4HRS 4,
             4H-6  .2*1H  /
DATA BCD94 / 4H FOR,4HCE -,4H- TA,4HRGET,4H FIN,4HGER-,
             4HRING,4H 1-3,4H     /
DATA BCD95 / 4H FOR,4HCE -,4H- TA,4HRGET,4H FIN,4HGER-,
             4HRING,4H 4-6,4H     /
DATA BCD96 / 4H FOR,4HCE -,4H- RI,4HNG F,4HINGE,4HR-TA,
             4HRGET,4H 1-3,4H     /
DATA BCD97 / 4H FOR,4HCE -,4H- RI,4HNG F,4HINGE,4HR-TA,
             4HRGET,4H 4-6,4H     /
DATA BCD98 / 4H LAT,4HCH L,4HOADS,4H 1-3,4H   L,4HBS  ,3*1H  /
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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      DATA BCD99/38H ACTIVE INTERFACE TORQUES,FT LBS         /
      DATA BCD100/38H TARGET INTERFACE TORQUES, FT LBS        /
      DATA BCD101/38HTARGET FINGER INTERFERENCE DISTANCE      /
      DATA BCD102 / 4H FCA,4HBM1 ,4H LBS,6*1H  /
      DATA BCD103 / 4H FCA,4HBM2 ,4H LBS,6*1H  /
      DATA BCD104 / 4H FCA,4HBM3 ,4H LBS,8*1H  /
      DATA BCD105 / 4H THO,4HTOR ,4H FT ,4HLBS ,5*1H  /
200   FORMAT(1H12X,'VARIABLE',33X,'MAXIMUM VALUE',9X,'AT TIME',
      5X,'MINIMUM VALUE',9X,'AT TIME')
300   FORMAT(1H02X,9A4,2(4X,E14.7,2X,E14.7))
301   FORMAT(1H 2X,36X,2(4X,E14.7,2X,E14.7))
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CHART TITLE - SUBROUTINE XMMX(LG,KNT)

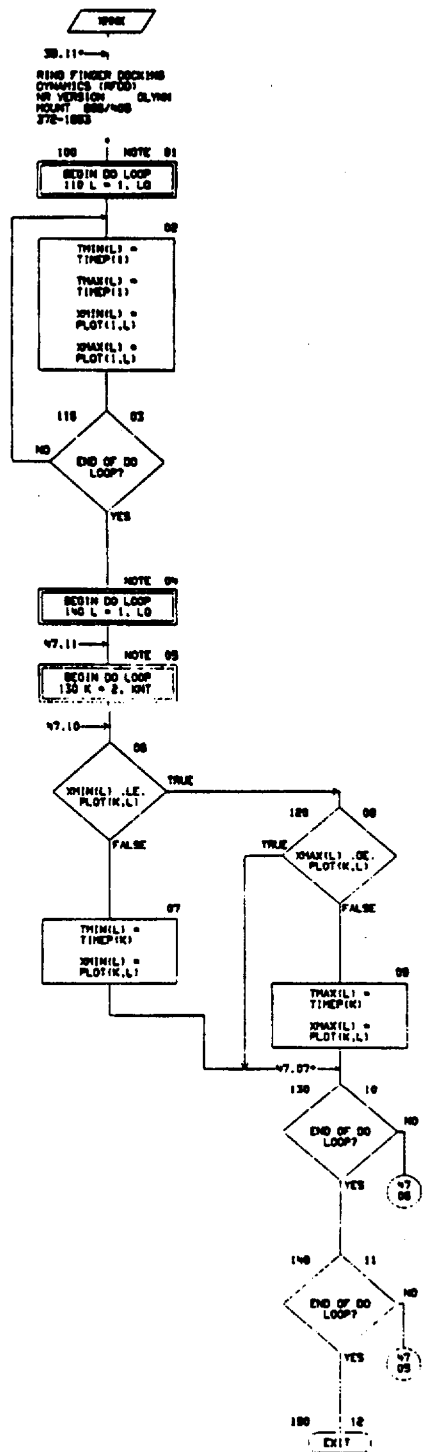

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION PLOT(1110,15),TIMEP(1110),IP(1110)
COMMON /GRAP/ PLOT,TIMEP,IP,IS
DIMENSION REC(43),XMAX(43),XMIN(43),TMAX(15),TMIN(15)
COMMON /GRAPHX/ XL,XR,XMIN,XMAX,TMIN,TMAX
```

CHART TITLE - SUBROUTINE OUTPT

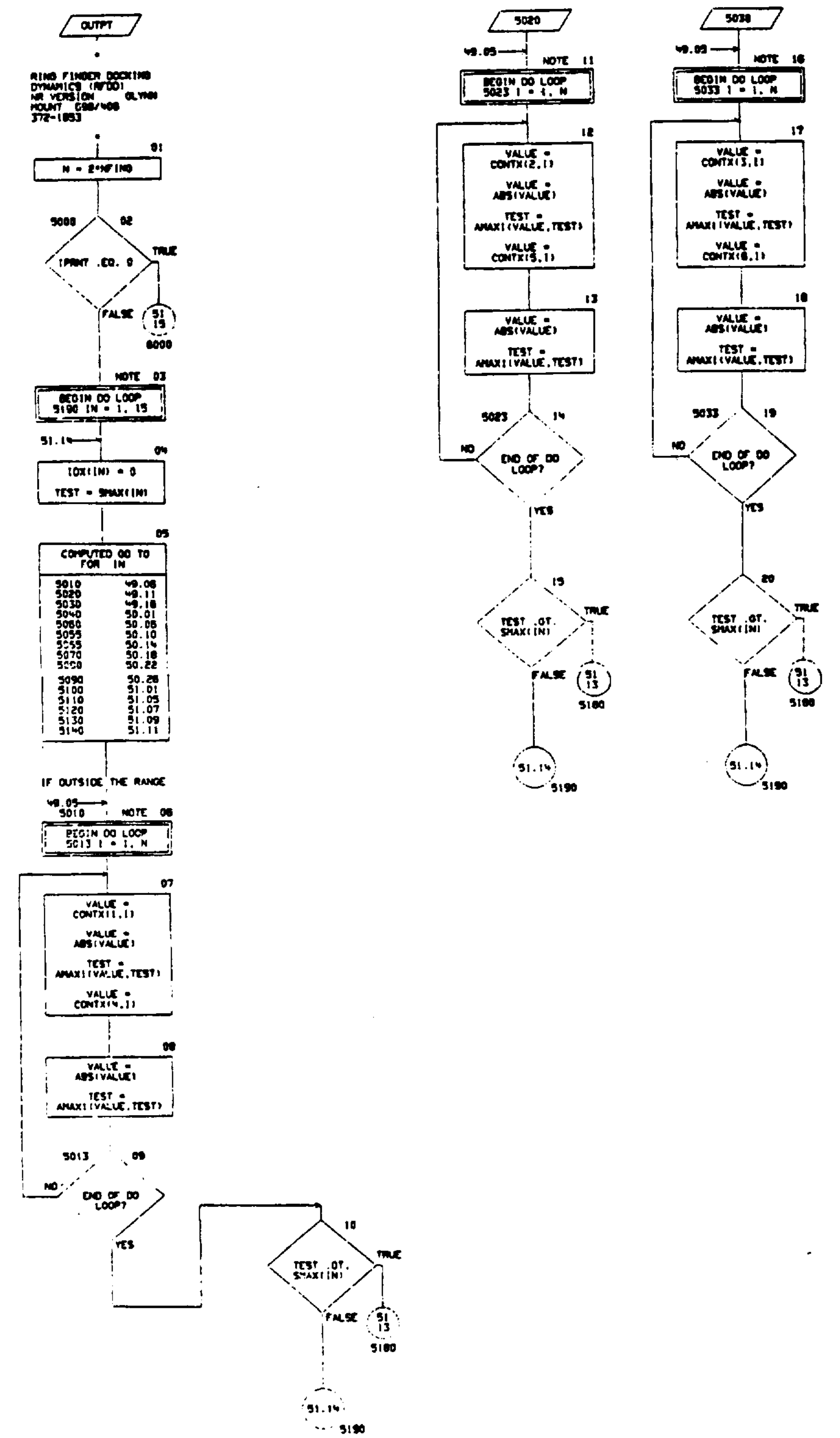

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CHART TITLE - SUBROUTINE OUTPT

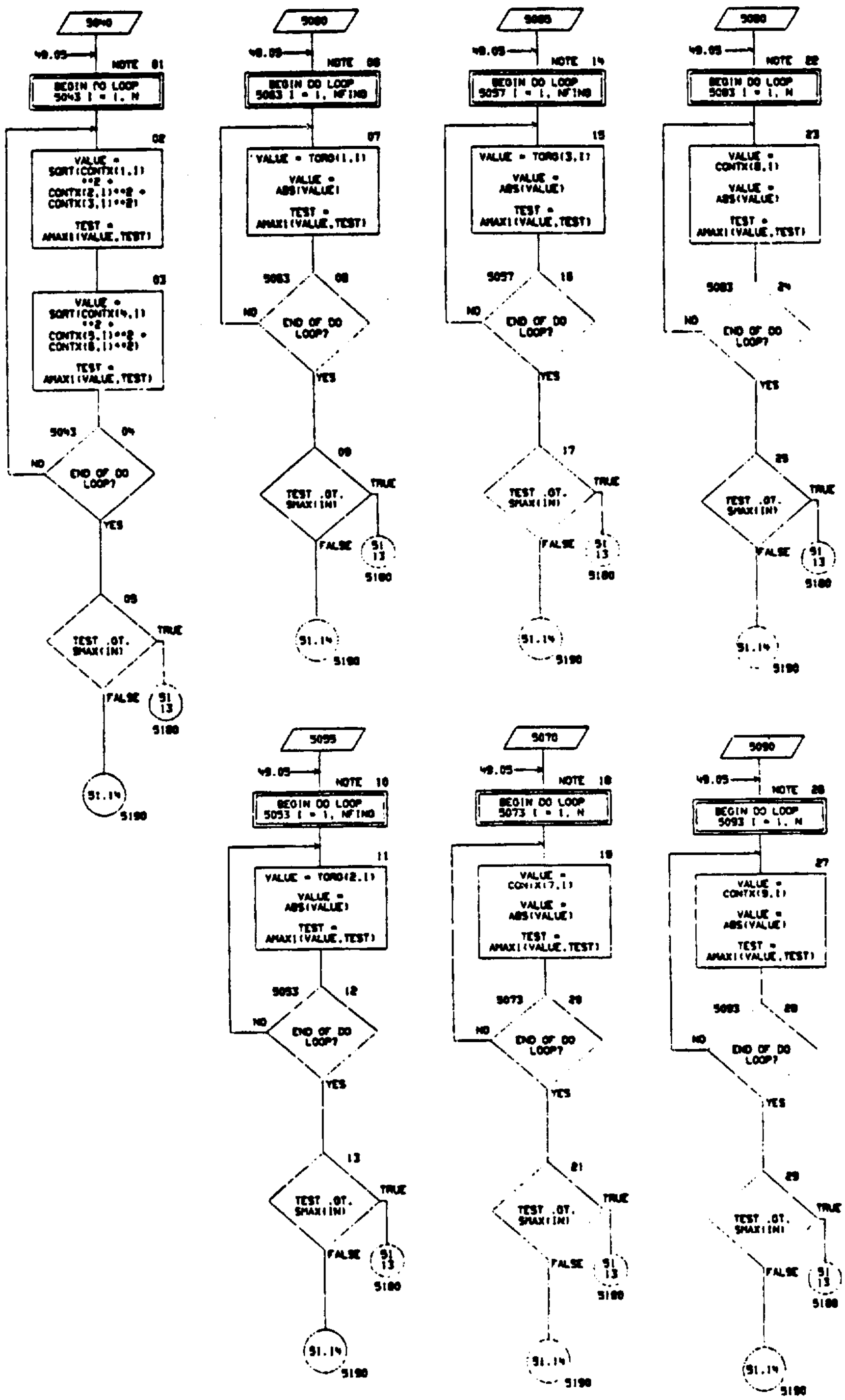

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CHART TITLE - SUBROUTINE OUTPT

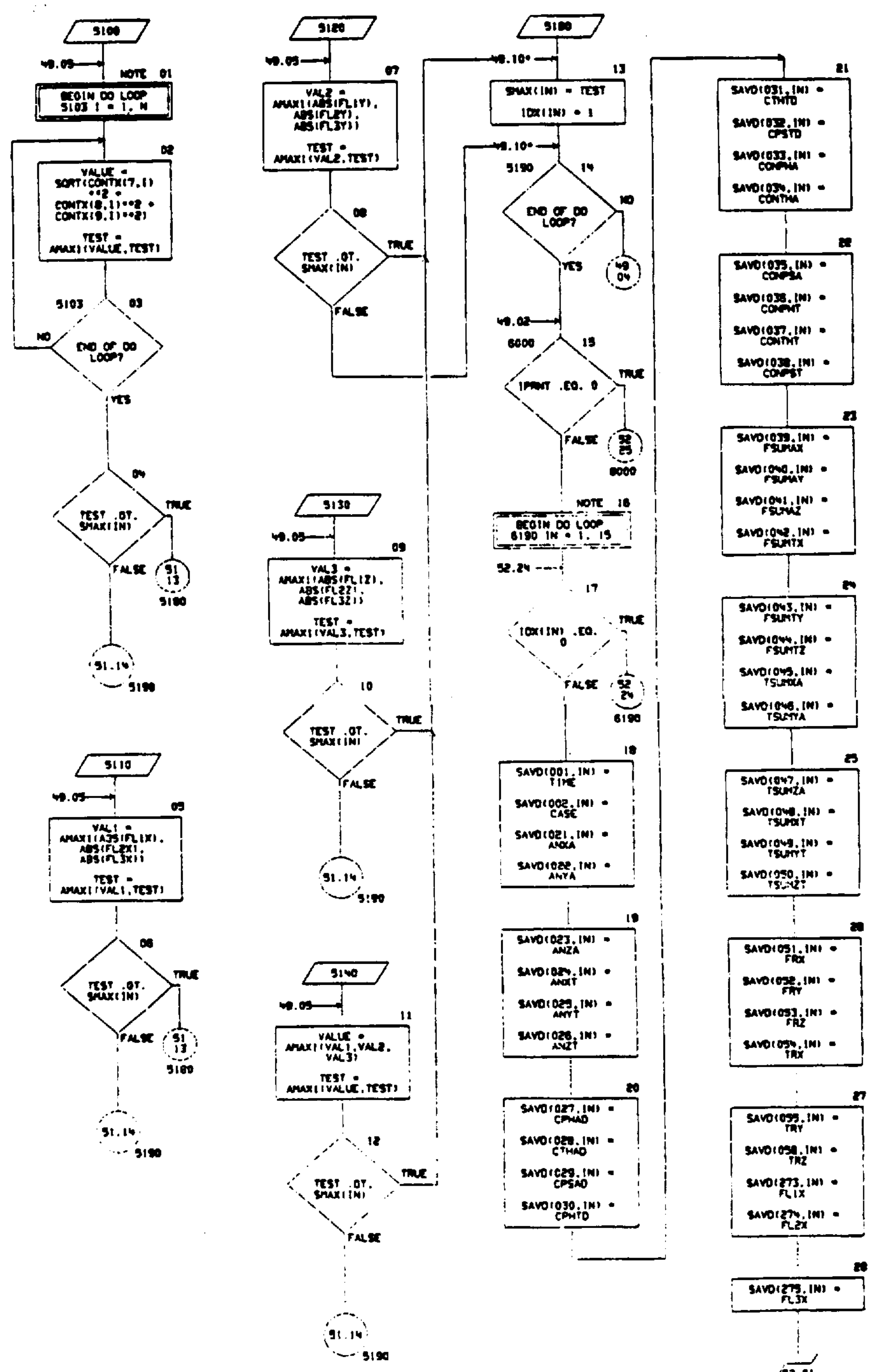

CHART TITLE - SUBROUTINE OUTPT

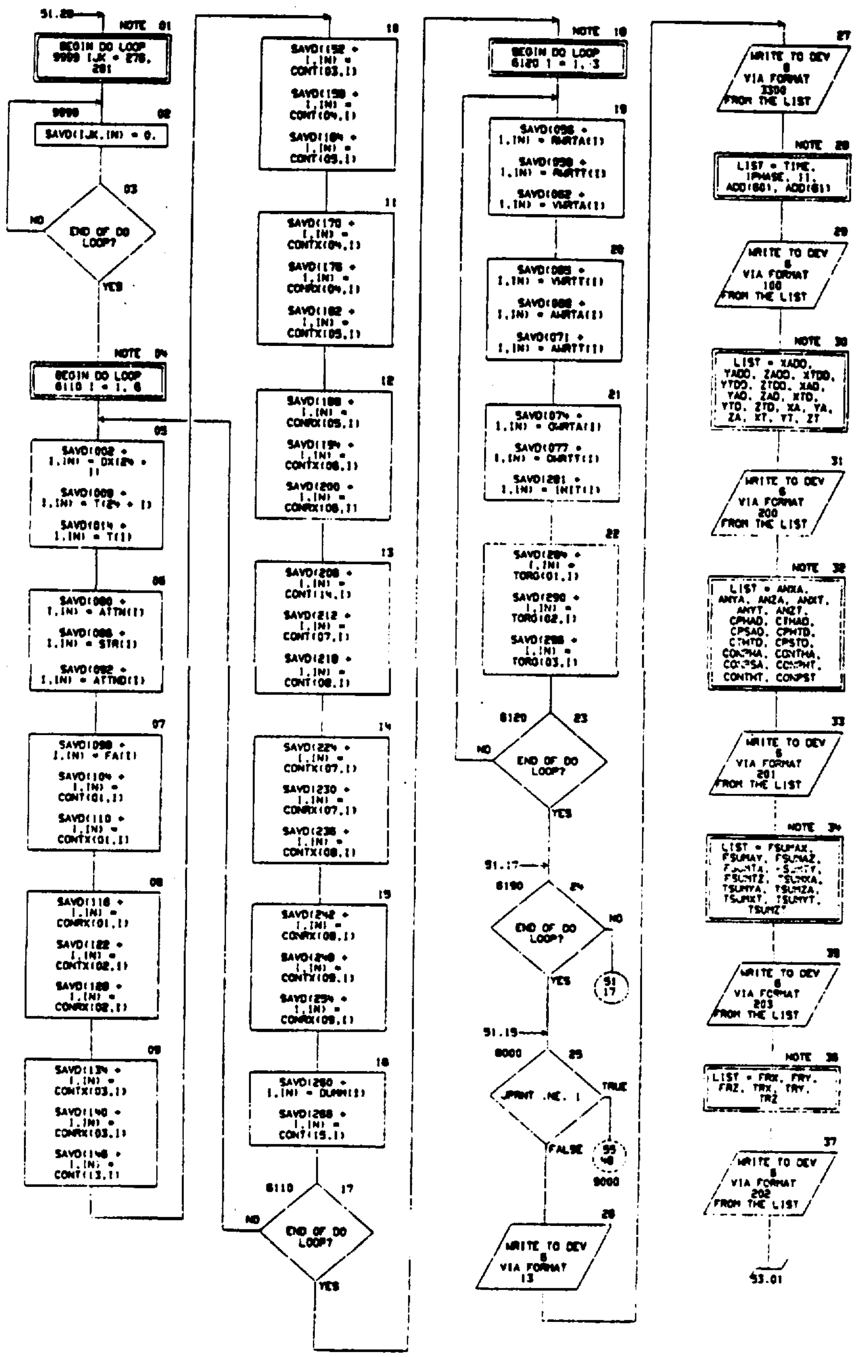

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CHART TITLE - SUBROUTINE OUTPT

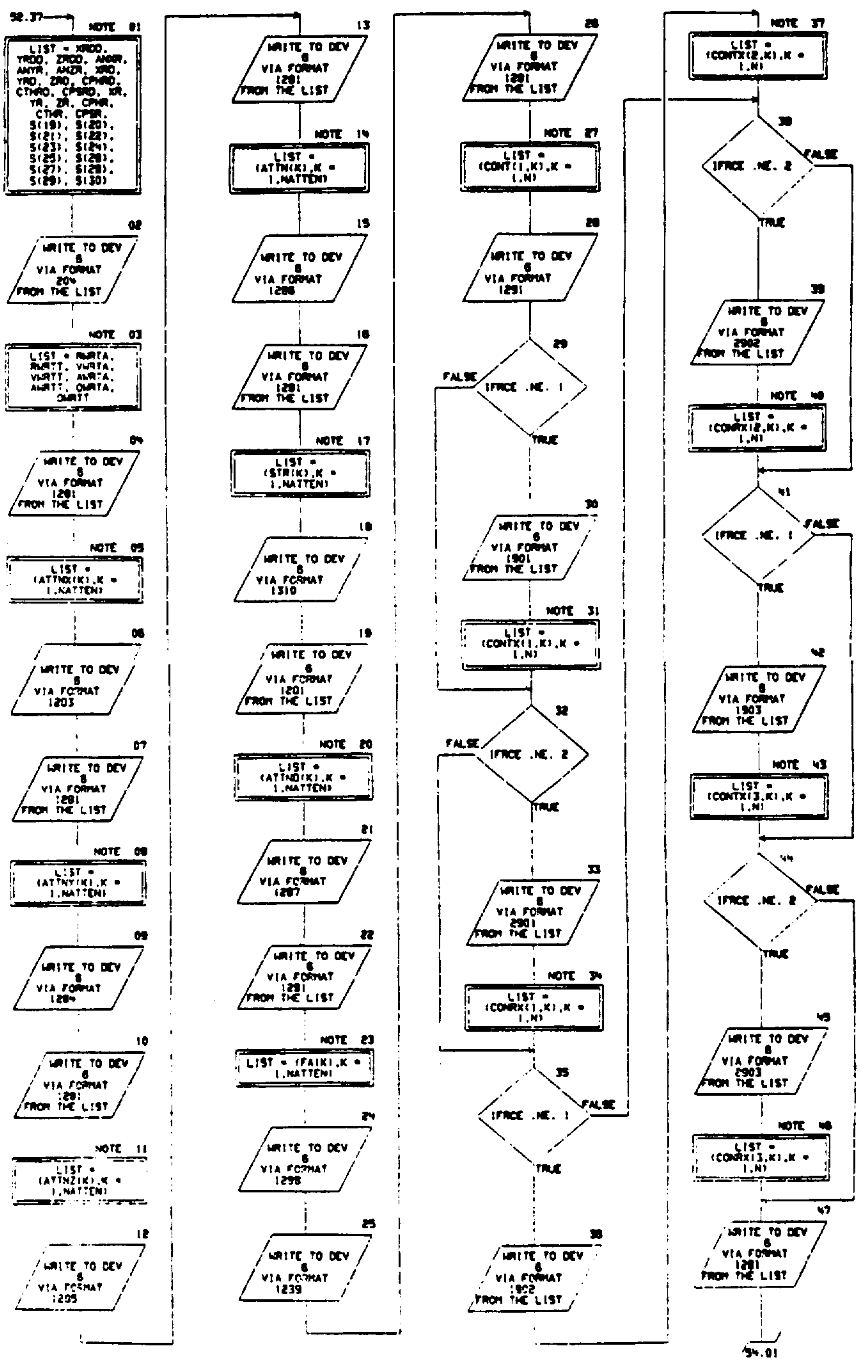

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CHART TITLE - SUBROUTINE OUTPT

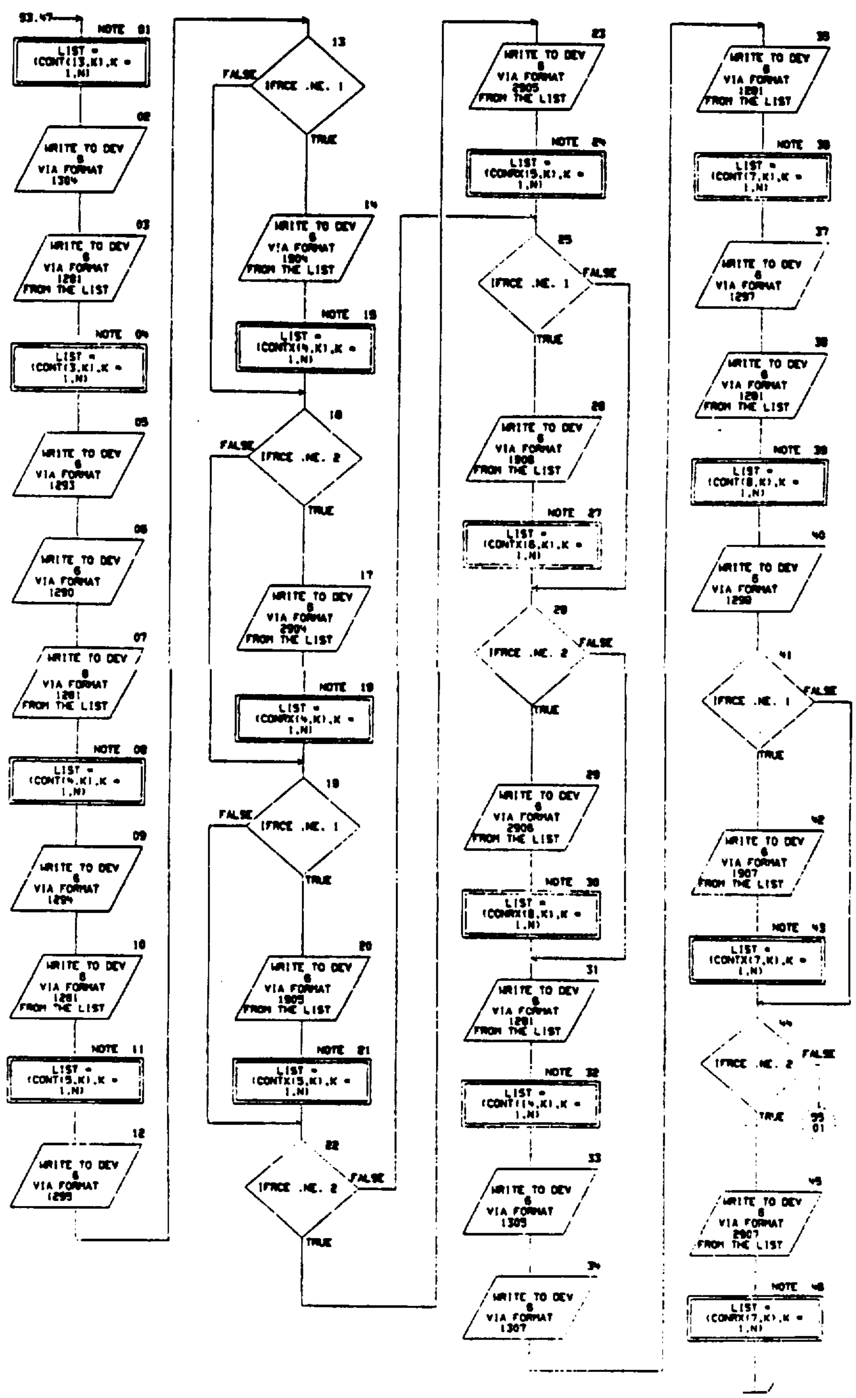

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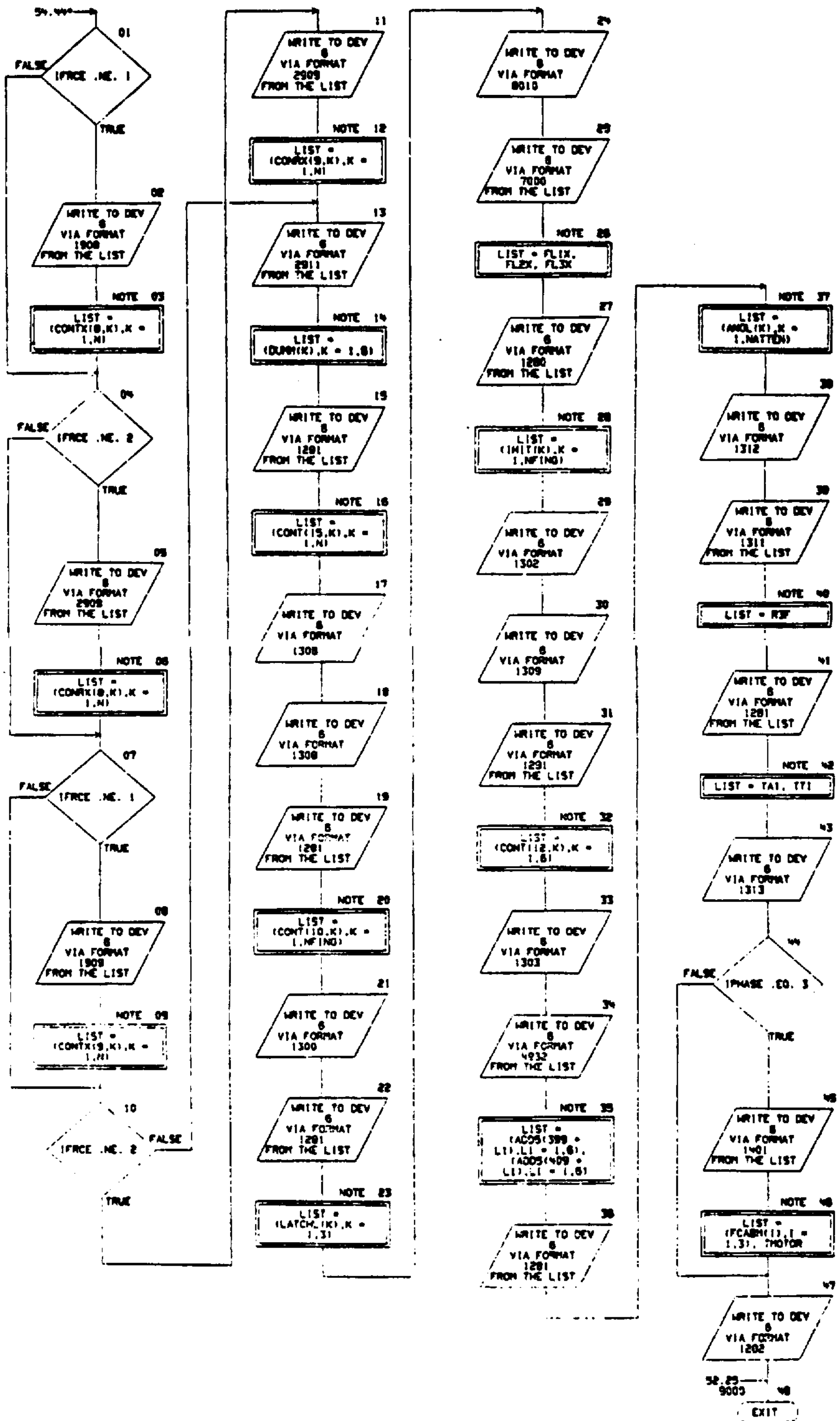
CHART TITLE - SUBROUTINE OUTPT



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Space Division
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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION ILATH(4),CONST(3)
 ,S(2285)
,ADD(100)
DIMENSION ATTNX(20),ATTNY(20),ATTNZ(20),ATTN(20),STR(20),FASK(20)
,ATTNO(20),FAD(20),FA(20),AJ(20),AK(20),TJ(20),TK(20),TH1(20)
 ,TH2(20)
DIMENSION VAR(2400),T(2285),A(15),B(15),C(50),D(30),E(15),F(10),
          AA(25),AT(30),CO(10),SS(10)
DIMENSION ATTNXO(8),ATTNYO(8),ATTNZO(8),ANGL(8)
COMMON/FIN/AR(3,40),ART(3,20)
COMMON/LATCH/ALATCH(3,4),CLATCH(3,20)
EQUIVALENCE(ADD(71),XL),(ADD(72),RADL)
DIMENSION ORLIM(3,3),V(3),V1(3)
            ,INIT(20)
EQUIVALENCE(ORLIM(1,1),ORL1)
DIMENSION CONT(15,20)
EQUIVALENCE(ADDS(1),CONT(1,1))
EQUIVALENCE(ADD(1),RR),(ADD(2),OFFJR),(ADD(3),OFFKR)
           ,(ADD(4),XMR),(ADD(5),XXIR),(ADD(6),YYIR),(ADD(7),ZZIR)
           ,(ADD(8),NFIND),(ADD(9),APRO),(ADD(13),AZS),(ADD(14),BET
          ),(ADD(15),TIPBET),(ADD(16),TPRO),(ADD(17),CHOP)
            ,(ADD(18),SK)
            ,(ADD(10),RSO),(ADD(11),AXS),(ADD(12),AYS)
            ,(ADD(19),DISC),(ADD(20),ISTART)
EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
            (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
            (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
            (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
            (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
            (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
            (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
            (T(29),YTD),(T(30),ZTD)
EQUIVALENCE(T(31),XRD),(T(32),YRD),(T(33),ZRD),(T(34),XR),(T(35),
       YR),(T(36),ZR),(T(37),THR),(T(38),PSR),(T(39),PHR),(T(40),
    OMEGXR),(T(41),OMEGYR),(T(42),OMEGZR)
            ,(S(45),INIT(1))
EQUIVALENCE (DX(1),DXAD),(DX(2),DYAD),(DX(3),DZAD),(DX(4),DXTD),
            (DX(5),DYTD),(DX(6),DZTD),(DX(7),OMEXAD),(DX(8),OMEYAD
            ),(DX(9),OMEZAD),(DX(10),OMEXTD),(DX(11),OMEYTD),
            (DX(12),OMEZTD),(DX(13),THAD),(DX(14),PHAD),
            (DX(15),PSAD),(DX(16),THTD),(DX(17),PHTD),(DX(18),PSTD
           ),(DX(19),XPD),(DX(20),YPD),(DX(21),ZPD)
           ,(DX(24),ZDD),(DX(25),XADD),(DX(26),YADD),
           (DX(27),ZADD),(DX(28),XTDD),(DX(29),YTDD),(DX(30),ZTDD)
EQUIVALENCE(DX(31),XRDD),(DX(32),YRDD),(DX(33),ZRDD),(DX(34),DXRD)
           ,(DX(35),DYRD),(DX(36),DZRD),(DX(37),THRD),(DX(38),PSRD)
           ,(DX(39),PHRD),(DX(40),OMEXRD),(DX(41),OMEYRD)
           ,(DX(42),OMEZRD)
EQUIVALENCE (A(2),XMA),(A(3),XXIA),(A(4),YYIA),(A(5),ZZIA),
            (A(6),XYIA),(A(7),XZIA),  (A(8),YZIA),(A(9),OFFJA),
            (A(10),OFFKA),(A(11),RA)
EQUIVALENCE (B(2),XMT),(B(3),XXIT),(B(4),YYIT),(B(5),ZZIT),
            (B(6),XYIT),(B(7),XZIT),(B(8),YZIT),(B(9),OFFJT),
            (B(10),OFFKT),(B(11),RT)
EQUIVALENCE (C(1),NATTEN),(C(2),DA),(C(3),DT),(C(4),ALPHA)
,(C(8),THNT),(C(9),PRELD1),(C(10),DELPRE),(C(11),BRATE)
,(C(47),ISIMPL),(D(4),IHUNT)
.           (C(7),THMA),(C(19),THORD),(C(20),XMISS)
 , (C(5),EXT),(SLOP,C(6))
EQUIVALENCE(MPLOT,E(1))
, (S(19),FRCSXA),(S(20),FRCSYA),(S(21),FRCSZA),(S(22),FRCSXT),
 (S(23),FRCSYT),(S(24),FRCSZT),(S(25),TRCSXA),(S(26),TRCSYA),
 (S(27),TRCSZA),(S(28),TRCSXT),(S(29),TRCSYT),(S(30),TRCSZT)
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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      DIMENSION STI(10),FSKOIL(10),ATTNI(10)
      EQUIVALENCE(S(65),STI(1)),(S(75),FSKOIL(1))
      EQUIVALENCE (E(2),IPHASE),(E(3),STOP),(E(4),DELPP),(E(5),CASE),
                  (E(6),IGRAPH),(E(7),DELP),(E(8),DESLC),(E(9),JN),
                  (E(10),ICASE)
      EQUIVALENCE (F(2),THESH),(F(4),A3),(F(5),A5),(F(6),KA1),
                  (F(7),A2),(F(8),A4),(F(9),A7)
      EQUIVALENCE (AA(2),THCOMA),(AA(3),PHCOMA),(AA(4),PSCOMA),
                  (AA(5),ARXA),(AA(6),ARYA),(AA(7),ARZA),(AA(8),ADPHA),
                  (AA(9),ADTHA),(AA(10),ADPSA),(AA(11),TXA),(AA(12),TYA)
                 ,(AA(13),TZA),(AA(14),DBANXA),(AA(15),DBANYA),
                  (AA(16),DBANZA),(AA(17),FXA),(AA(18),REACTA),
                  (AA(19), BANXA),(AA(20),BANYA),(AA(21),BANZA)
      EQUIVALENCE (AT(2),DRNOR),(AT(3),DYRX),(AT(4),TRCST),(AT(5),DPX),
                  (AT(6),ARXT),(AT(7),ARYT),(AT(8),ARZT),(AT(9),ADPHT),
                  (AT(10),ADTHT),(AT(11),ADPST),(AT(12),DBANXT),
                  (AT(13),DBANYT),(AT(14),DBANZT),(AT(15),THCONT),
                  (AT(16),PHCONT),(AT(17),PSCONT),(AT(18),REACTT),
                  (AT(19),BANXT),(AT(20),BANYT),(AT(21),BANZT),
                  (AT(22),TXT),(AT(23),TYT),(AT(24),TZT),(AT(25),FXT),
                  (AT(26),RMAXT),(AT(27),YMAXT),(AT(28),PMAXT),
                  (AT(29),IRCS),(AT(30),IVEH)
      EQUIVALENCE (VAR(1),A(1)),(VAR(6),B(1)),(VAR(3),C(1)),
                  (VAR(8)),D(1)),(VAR(11)),E(1)),(VAR(126),F(1)),
                  (VAR(138),AA(1)),(VAR(161)),AT(1)),(VAR(191),CO(1)),
                  (VAR(201)),SS(1)),(VAR(211),T(1))
      DIMENSION XAXR(3),RCG3(3),XAXRA(3),RCG3A(3),XTXA(3),RVTP(3),
                GAMAM(3,3),GAMEM(3,3),XTXAA(3),RVT(3),RVTA(3),SRWRTA(3)
               ,RCG2(3),RWRTA(3),VRA(3),VRAA(3),OR(3),VOR(3),VORA(3),
                VWRTA(3),VTA(3),ORA(3),OTA(3),VTAA(3),VOTA(3),VRT(3),
                VRTT(3),SVORT(3),ORT(3),GAMDM(3,3),        GAMTM(3,3)
               ,GAMRM(3,3),AWRTA(3),OA(3),OT(3),VOA(3),        OWRTA(3),
      XTXR(3),XTXRT(3),RCLS(3),RCLST(3),SRCLST(3),RWRTT(3),AWRTT(3),
      VOT(3),VORT(3),VWRTT(3),OWRTT(3)
      EQUIVALENCE (RCG3(1),ADD(1)),(GAMAM(1,1),GAMA11),(GAMEM(1,1),
                  GAME11),(GAMRM(1,1),GAMR11),(T(40),OR(1)),(OA(1),T(7))
                 ,(OT(1),T(10)),(GAMDM(1,1),GAMD11),(GAMTM(1,1),GAMT11)
                 ,(RCLS(1),ADD(11))
      COMMON/OUTN/XAXR,RVT,XTXR
      COMMON VAR
      COMMON/RET/ILOSS
      COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
       GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
       GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
       GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
       GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
       GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
       GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
       GAMP32,GAMP33
      ,GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
      COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
       ,PRCZEA,TLSA,II,IKAI,THESHI,CONST
      COMMON/ANGLE/STHA,CTHA,SPHA,CPHA,SPSA,CPSA,
                   STHT,CTHT,SPHT,CPHT,SPST,CPST
      COMMON/IHARD/ILATH,RP2,XL4,RP3,XL3,FLATCH,TLATY,TLATZ,THU2,THU3
      COMMON/RECAL/S
      COMMON/CALCU/F0,FC,F1,TORL,FS1,FS2,FS3,FCR1,FCR2,FCR3,ETA1,
       ETA2,ETA3,FRT1A,FRT2A,FRT3A,TLS1,TLS2,TLS3,FRT1B,FRT2B,FRT3B,
       VELB1,VELB2,VELB3,VELP,FRICP,FRC1,FRC2,FRC3,PROBEL
      COMMON /LOD/YARM1,YARM2,YARM3,XLCB1,XLCB2,XLCB3
      COMMON/FORC/FSUMAX,FSUMAY,FSUMAZ,TSUMXA,TSUMYA,TSUMZA,TSUMXT,
       TSUMYT,TSUMZT,FSUMTX,FSUMTY,FSUMTZ
      COMMON/OUT/FGX,FGY,FGZ,TORX,TORY,TORZ,STRB1,STRB2,STRB3,STRPR,
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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              FCX,FCY,FCZ
        COMMON/PULL/RETRAC
        COMMON/IOH/IOHT
        COMMON/ERR/THAPE,PHAPE,PSAPE,THTPE,PHTPE,PSTPE
        COMMON/HARDFT/HARDXA,HARDYA,HARDZA,THRXA,THRYA,THRZA
        COMMON/ADDNEW/ADD
        COMMON /ADDLF/ ALF(50)
        DIMENSION ABB(10),ORD(10),SS2(10),CO2(10)
        EQUIVALENCE (ALF(0)),ABB(1)),(ALF(11),ORD(1)),
                    (ALF(21),SS2(1)),(ALF(31),CO2(1)),
                    (ALF(41),ITSPD), (ALF(42),JNE)
        COMMON/ATTACH/AJ,AK,TJ,TK,FA,ATTND,STR,ATTN,TH1,TH2,ATTNO
        .ATTNX,ATTNY,ATTNZ
        COMMON/EFLEX/TIME,DX(150),ADDS(1000)
        COMMON /ANGLER/STHR,CTHR,SPHR,CPHR,SPSR,CPSR
        COMMON/FORCR/FRX,FRY,FRZ,TRX,TRY,TRZ
        COMMON/TRANR/OR11,OR21,OR31,OR12,OR22,OR32,OR13,OR23,OR33
        COMMON/TIM/TIMEO
        DIMENSION TRTA(3,20),OFIN(3,3,4),R3A(3,4),R3T(3,4)
         ,R3F(3,4),RS(3,4)
        DIMENSION TAI(3),TTI(3),TAIC(3),TTIC(3),RCO4(3)
        COMMON/STRV/TRT(3,20)
        EQUIVALENCE(C(23),RSX),(C(24),RSR)
        DOUBLE PRECISION TTL1,TTL2
        COMMON /TITLES/ TTL1(8),TTL2(8)
        COMMON /CA/ VCABR(3,10),VCABB(3,10),CABL(3,10),FCAB(3,10),
                    THOTOR,FCABM(10)
        EQUIVALENCE (D(20),XCR),(D(21),CRADB),(D(22),CRADR),(D(17),XB)
        COMMON /FRCE/ CONTK(9,8),CONRK(9,8),IFRCE
                      ,DELST(10)
        EQUIVALENCE (SKS,C(9))
        DIMENSION DUMM(10)
        COMMON /DUMMY/ ANXA,ANYA,ANZA,CONPHA,CONTHA,CONPSA,
                       ANXT,ANYT,ANZT,CONPHT,CONTHT,CONPST
        COMMON /SAVC/ SAVD(302,15),SMAX(15),IDX(15)
        COMMON /REST/ CPHAD,CTHAD,CPSAD,CPHTD,CTHTD,CPSTD,
                      ANXR,ANYR,ANZR,CPHRD,CTHRD,CPSRD,
                      RMRTA,RMRTT,VMRTA,VMRTT,AMRTA,AMRTT,
                      OMRTA,OMRTT,IPRNT,JPRNT,JPLOT,
                      DUMM,FL1X,FL2X,FL3X,FL1Y,FL2Y,FL3Y,FL1Z,FL2Z,FL3Z,
                      ANGL,R3F,TAI,TTI
        COMMON /MRK/ TORQ(3,8)
        REAL*4 LATCHL
        COMMON /FOLLY/LATCHL(3)
13      FORMAT(1H1)
3300    FORMAT(5H TIMEE13.6,6H PHASE,I12,3H I1,I15,5H XL  E13.6,
        5H THP1E13.6)
100     FORMAT(' XADD',E13.6,' YADD',E13.6,' ZADD',E13.6,
               ' XTDD',E13.6,' YTDD',E13.6,' ZTDD',E13.6/
               ' XAD ',E13.6,' YAD ',E13.6,' ZAD ',E13.6,
               ' XTD ',E13.6,' YTD ',E13.6,' ZTD ',E13.6/
               ' XA  ',E13.6,' YA  ',E13.6,' ZA  ',E13.6,
               ' XT  ',E13.6,' YT  ',E13.6,' ZT  ',E13.6 )
200     FORMAT(' OXA ',E13.6,' OYA ',E13.6,' OZA ',E13.6,
               ' OXT ',E13.6,' OYT ',E13.6,' OZT ',E13.6/
               ' PHAD',E13.6,' THAD',E13.6,' PSAD',E13.6,
               ' PHTD',E13.6,' THTD',E13.6,' PSTD',E13.6/
               ' PHA ',E13.6,' THA ',E13.6,' PSA ',E13.6,
               ' PHT ',E13.6,' THT ',E13.6,' PST ',E13.6 )
201     FORMAT(' FSAX',E13.6,' FSAY',E13.6,' FSAZ',E13.6,
               ' FSTX',E13.6,' FSTY',E13.6,' FSTZ',E13.6/
               ' TSXA',E13.6,' TSYA',E13.6,' TSZA',E13.6,
               ' TSXT',E13.6,' TSYT',E13.6,' TSZT',E13.6 )
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203     FORMAT(' FRX ',E13.6,' FRY ',E13.6,' FRZ ',E13.6,
               ' TRX ',E13.6,' TRY ',E13.6,' TRZ ',E13.6 )
202     FORMAT(' XRDD',E13.6,' YRDD',E13.6,' ZRDD',E13.6,
               ' ANXR',E13.6,' ANYR',E13.6,' ANZR',E13.6/
               ' XRD ',E13.6,' YRD ',E13.6,' ZRD ',E13.6,
               ' PHRD',E13.6,' THRD',E13.6,' PSRD',E13.6/
               ' XR  ',E13.6,' YR  ',E13.6,' ZR  ',E13.6,
               ' PHR ',E13.6,' THR ',E13.6,' PSR ',E13.6/
               ' FCAX',E13.6,' FCAY',E13.6,' FCAZ',E13.6,
               ' FCTX',E13.6,' FCTY',E13.6,' FCTZ',E13.6/
               ' TCAX',E13.6,' TCAY',E13.6,' TCAZ',E13.6,
               ' TCTX',E13.6,' TCTY',E13.6,' TCTZ',E13.6 )
204     FORMAT('   RWRTA1',E16.8,'   RWRTA2',E16.8,'   RWRTA3',E16.8/
               '   RWRTT1',E16.8,'   RWRTT2',E16.8,'   RWRTT3',E16.8/
               '   VWRTA1',E16.8,'   VWRTA2',E16.8,'   VWRTA3',E16.8/
               '   VWRTT1',E16.8,'   VWRTT2',E16.8,'   VWRTT3',E16.8/
               '   AWRTA1',E16.8,'   AWRTA2',E16.8,'   AWRTA3',E16.8/
               '   TWRTA1',E16.8,'   AWRTT2',E16.8,'   AWRTT3',E16.8/
               '   OWRTA1',E16.8,'   OWRTA2',E16.8,'   OWRTA3',E16.8/
               '   OWRTT1',E16.8,'   OWRTT2',E16.8,'   OWRTT3',E16.8)
1203    FORMAT(1H+,'ATTNX(I)')
1204    FORMAT(1H+,'ATTNY(I)')
1205    FORMAT(1H+,'ATTNZ(I)')
1206    FORMAT(1H+,'ATTN(I)')
1310    FORMAT(1H+,'STR(I)')
1207    FORMAT(1H+,'ATTNO(I)')
1208    FORMAT(1H+,'FA(I)')
1201    FORMAT(1H 10X,8E15.7)
1289    FORMAT('***** CONTACT BETWEEN RING FINGERS AND TARGET FINGERS ')
1291    FORMAT (1H+,'FINGER-R')
1901    FORMAT(1H ,'FORCE-FFTX',8E15.7)
2901    FORMAT(1H ,'FORCE-FFRX',8E15.7)
1902    FORMAT(1H ,'FORCE-FFTY',8E15.7)
2902    FORMAT(1H ,'FORCE-FFRY',8E15.7)
1903    FORMAT(1H ,'FORCE-FFTZ',8E15.7)
2903    FORMAT(1H ,'FORCE-FFRZ',8E15.7)
1304    FORMAT(1H+,'DIS-1')
1293    FORMAT (1H+,'FINGER-T')
1290    FORMAT('***** CONTACT BETWEEN RING AND TARGET FINGERS ')
1294    FORMAT (1H+,'ANGLE-R')
1295    FORMAT (1H+,'FINGER-T')
1904    FORMAT(1H ,'FORCE-RFTX',8E15.7)
2904    FORMAT(1H ,'FORCE-RFRX',8E15.7)
1905    FORMAT(1H ,'FORCE-RFTY',8E15.7)
2905    FORMAT(1H ,'FORCE-RFRY',8E15.7)
1906    FORMAT(1H ,'FORCE-RFTZ',8E15.7)
2906    FORMAT(1H ,'FORCE-RFRZ',8E15.7)
1305    FORMAT(1H+,'DIS-2')
1307    FORMAT('***** CONTACT BETWEEN FINGERS ON RING AND TARGET RING' )
1297    FORMAT (1H+,'ANGLE-T')
1298    FORMAT (1H+,'FINGER-A')
1907    FORMAT(1H ,'FORCE-FRTX',8E15.7)
2907    FORMAT(1H ,'FORCE-FRRX',8E15.7)
1908    FORMAT(1H ,'FORCE-FRTY',8E15.7)
2908    FORMAT(1H ,'FORCE-FRRY',8E15.7)
1909    FORMAT(1H ,'FORCE-FRTZ',8E15.7)
2909    FORMAT(1H ,'FORCE-FRRZ',8E15.7)
2911    FORMAT(' RING TO RING CONTACT LOADS'/
               ' FRRX1',E12.5,' FRRX2',E12.5,' FRRX3',E12.5,
               ' FRRX4',E12.5,' FRRX5',E12.5,' FRRX6',E12.5 )
1306    FORMAT(1H+,'DIS-3')
1308    FORMAT('***** LATCH DISTANCE AND FORCES ')
1300    FORMAT (1H+,'DELTAL')
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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
8010    FORMAT(1H+,' LATCHL')
7000    FORMAT(' LATCH LOADS'/' BEARING',7X,3E17.8/)
1280    FORMAT(1H ,9X,9I13)
1302    FORMAT(1H+,'IHIT')
1309    FORMAT('***** INTERACTION FORCE ON RING EXCLUDING ATTENUATOR FORCE
         ')
1303    FORMAT (1H+,'FRR,TRR')
4982    FORMAT(' *** CURRENT MAX ATTNEUATOR FORCES FOLLOWED BY MIN ATTENUA
        ATOR FORCES ****'/1H 8E15.8/1H 8E15.8)
1313    FORMAT(1H+,'TAI,TTI')
1311    FORMAT(1H ,8E15.8)
1312    FORMAT(1H ,'***** TARGET FINGER DISTANCE FROM CSM STRUCTURE ')
1401    FORMAT(    1H ,'*** CABLE RETRACTION MECHANISM'/1H ,
        'TENSION FORCES',5X,3E14.7/1H ,'MOTOR TORQUE  ',5X,E14.7)
1282    FORMAT(1H /)
```

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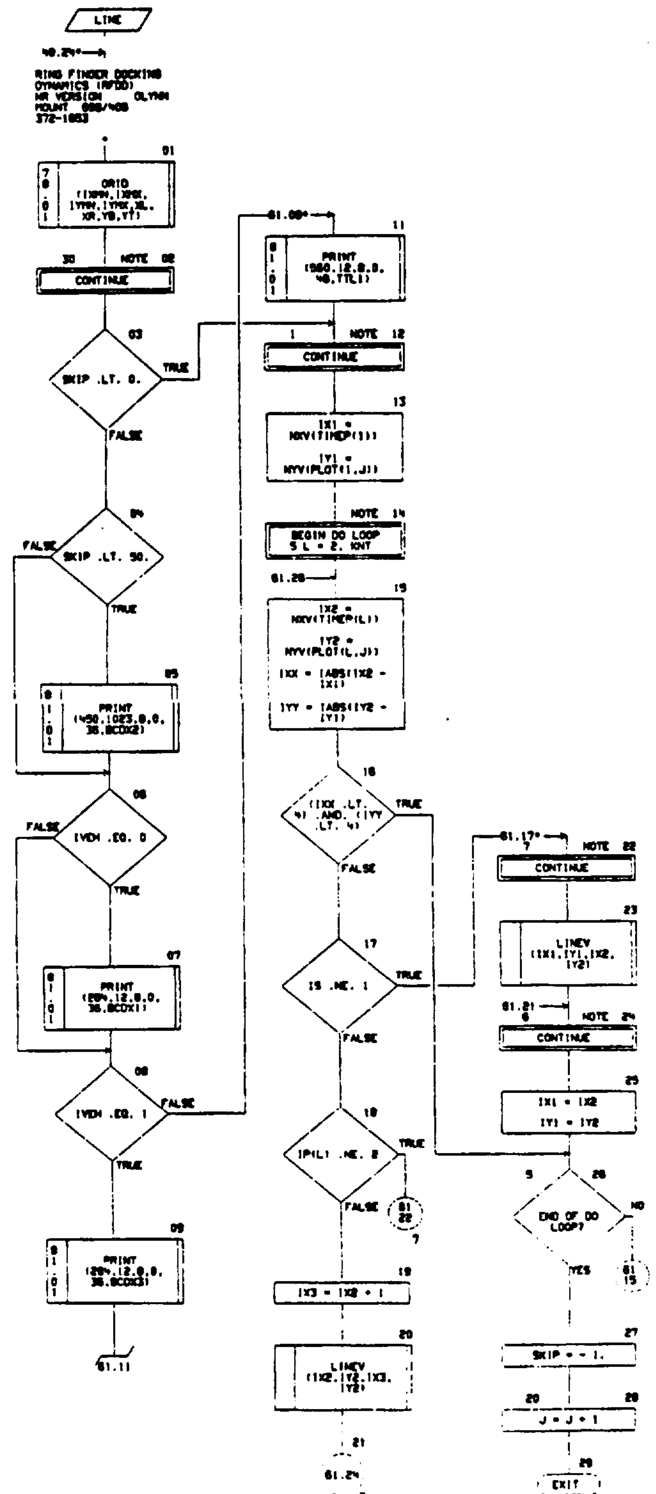
CHART TITLE - SUBROUTINE LINE(IXMN,IXMX,IYMN,IYMX,XL,XR,YB,YT,KNT,SKIP,J)



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Space Division
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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION PLOT(1110,15),TIMEP(1110),IP(1110)
COMMON/GRAP/PLOT,TIMEP,IP,IS
DIMENSION BCDX1(9),BCDX2(9),BCDX3(9)
COMMON/CAS/CASE
DIMENSION VAR(2400)
COMMON VAR
EQUIVALENCE (VAR(190),IVEH)
COMMON /TITLES/TTL1(12)
DATA BCDX1 / 4H  DO,4HCKIN,4HG DY,4HNAMI,4HCS  ,4H-  C,
            4HASE ,4HNO. ,4H=    /
DATA BCDX2 / 4H TIM,4HE - ,4HSECO,4HNDS ,5*1H  /
DATA BCDX3 / 4H  DO,4HCKIN,4HG DY,4HNAMI,4HCS  ,4H-  C,
            4HASE ,4HNO. ,4H=    /
```

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CHART TITLE - SUBROUTINE GRAPH1(N,BCD1,BCD2,BCD3,XNT,SKIP,J)

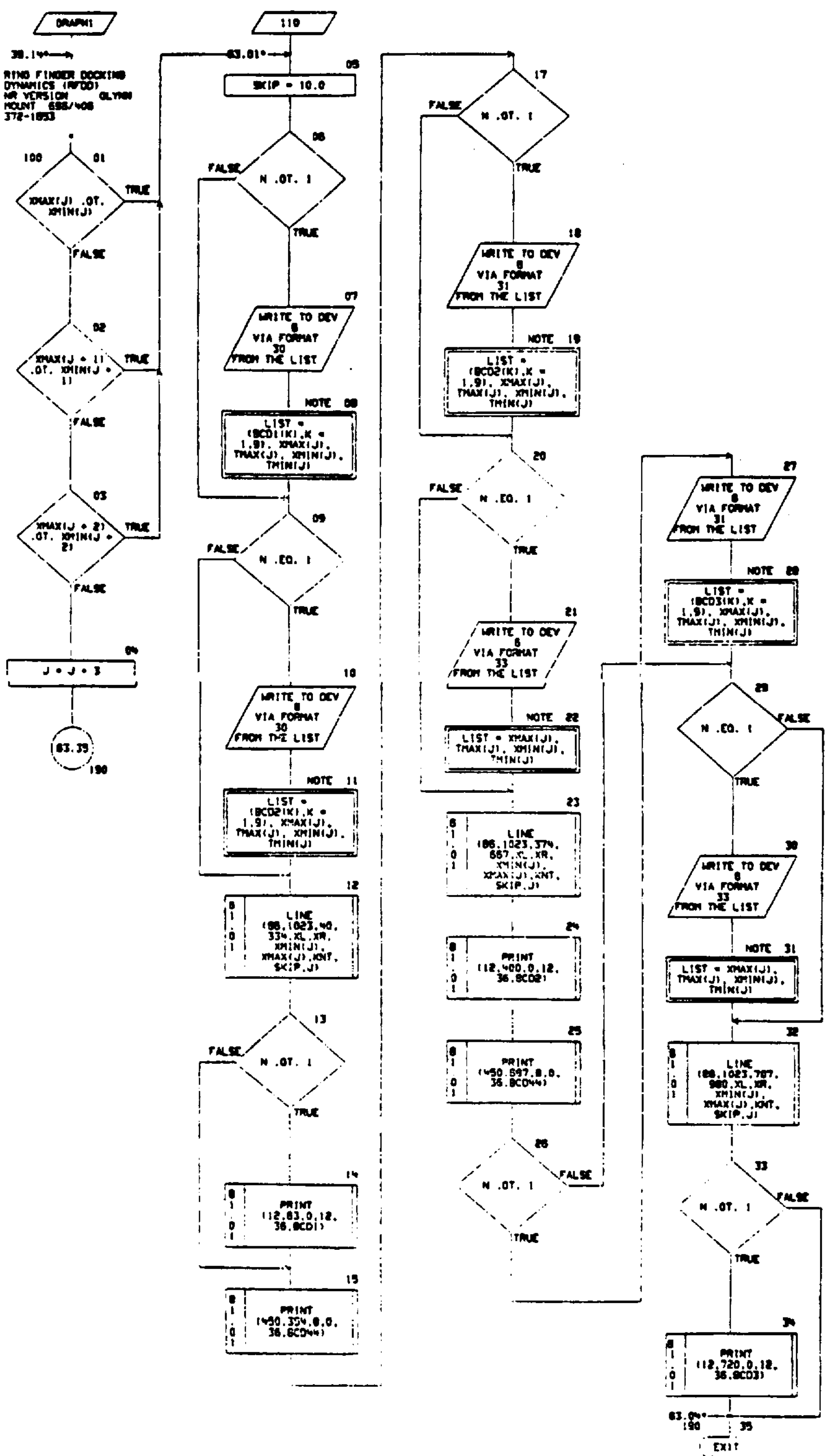

CHART TITLE - NON-PROCEDURAL STATEMENTS

```
      DIMENSION BCD1(9),BCD2(9),BCD3(9),BCD44(9),
               XMIN(43),XMAX(43),TMIN(15),TMAX(15)
      COMMON /GRAPHX/ XL,XR,XMIN,XMAX,TMIN,TMAX
      DATA BCD44 / 4H TIM,4HE - ,4HSECO,4HNDS ,5*1H  /
30    FORMAT(1H02X,9A4,2(4X,E14.7,2X,E14.7))
31    FORMAT(1H 2X,9A4,2(4X,E14.7,2X,E14.7))
33    FORMAT(1H 2X,36X,2(4X,E14.7,2X,E14.7))
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CHART TITLE - SUBROUTINE RCS

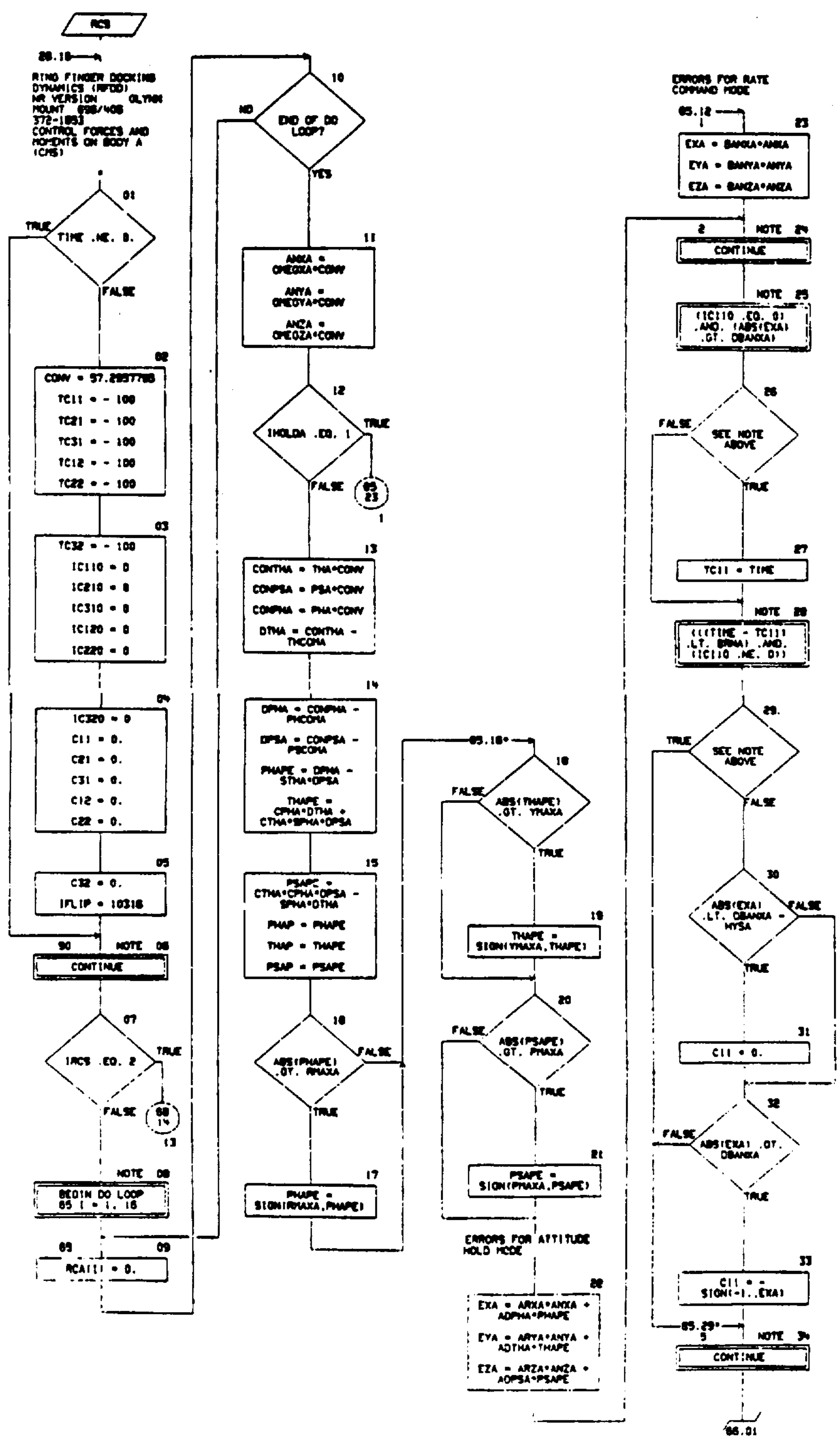

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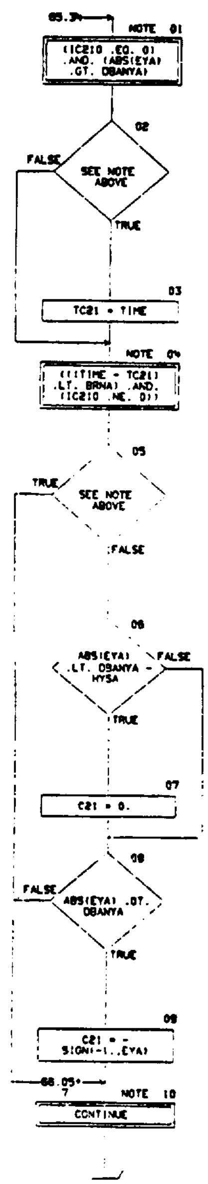
CHART TITLE - SUBROUTINE RCS



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Space Division
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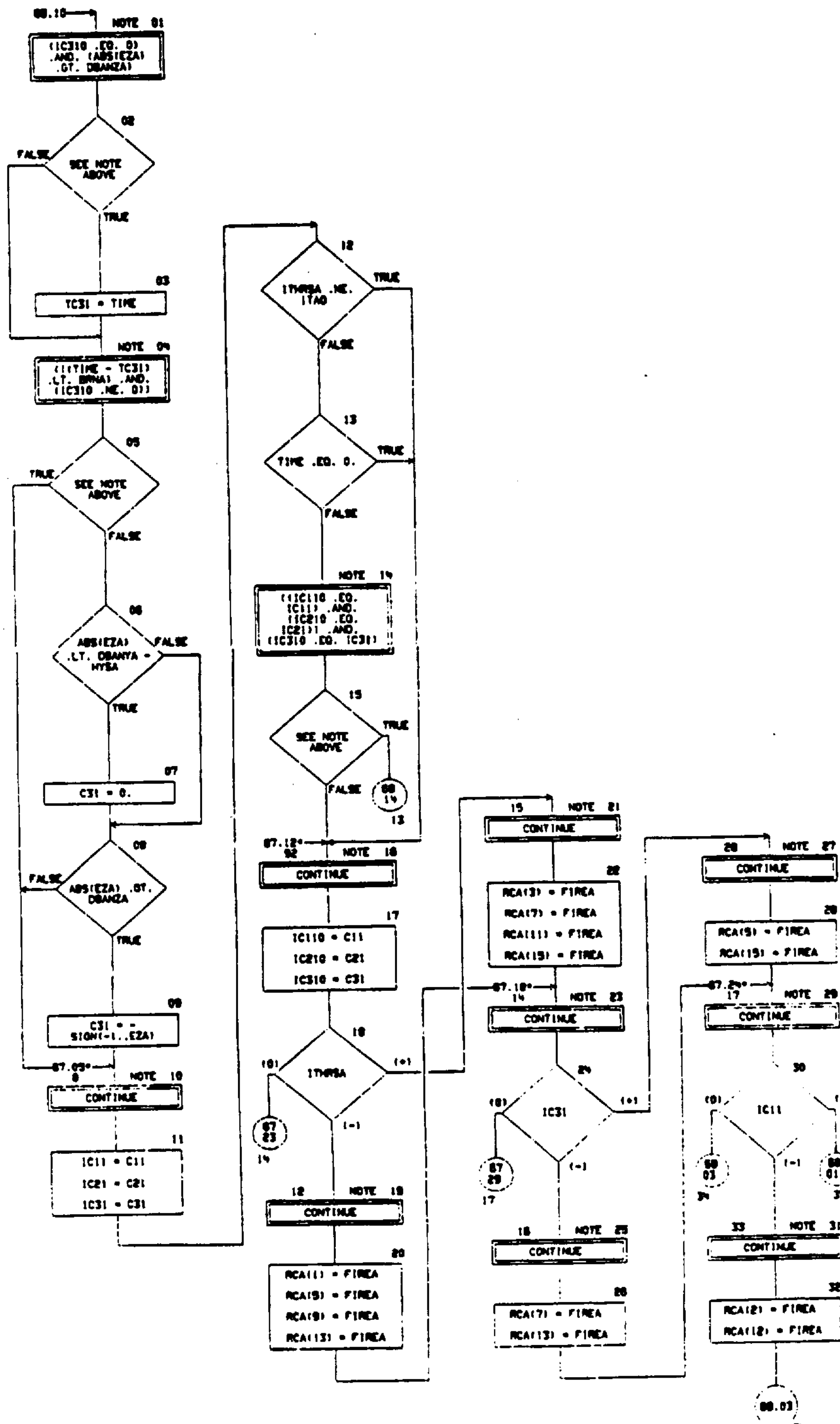
CHART TITLE - SUBROUTINE RCS



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Space Division
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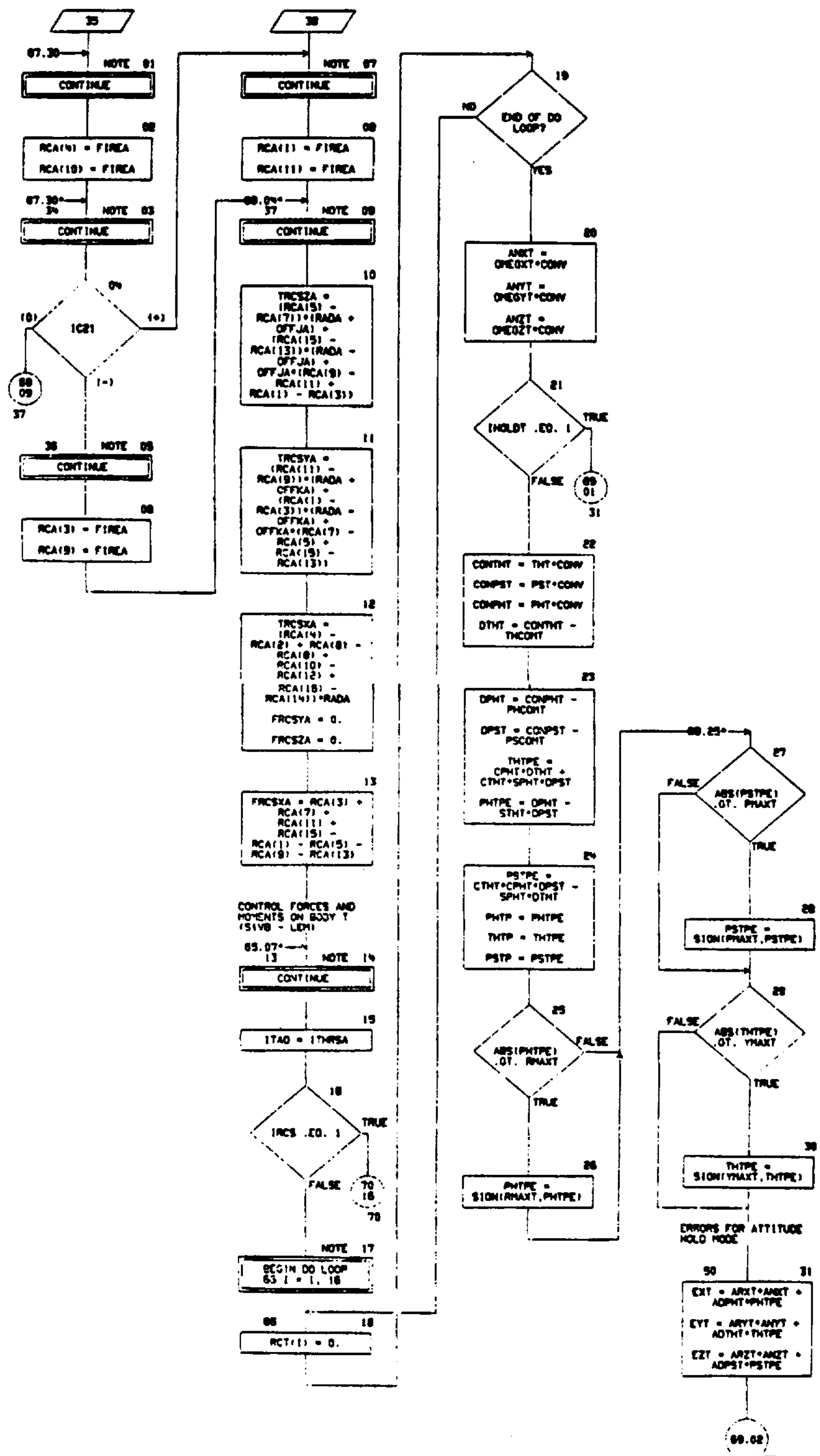
SD 74-CS-0023

CHART TITLE - SUBROUTINE RCS



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Space Division Rockwell International

CHART TITLE - SUBROUTINE RCS

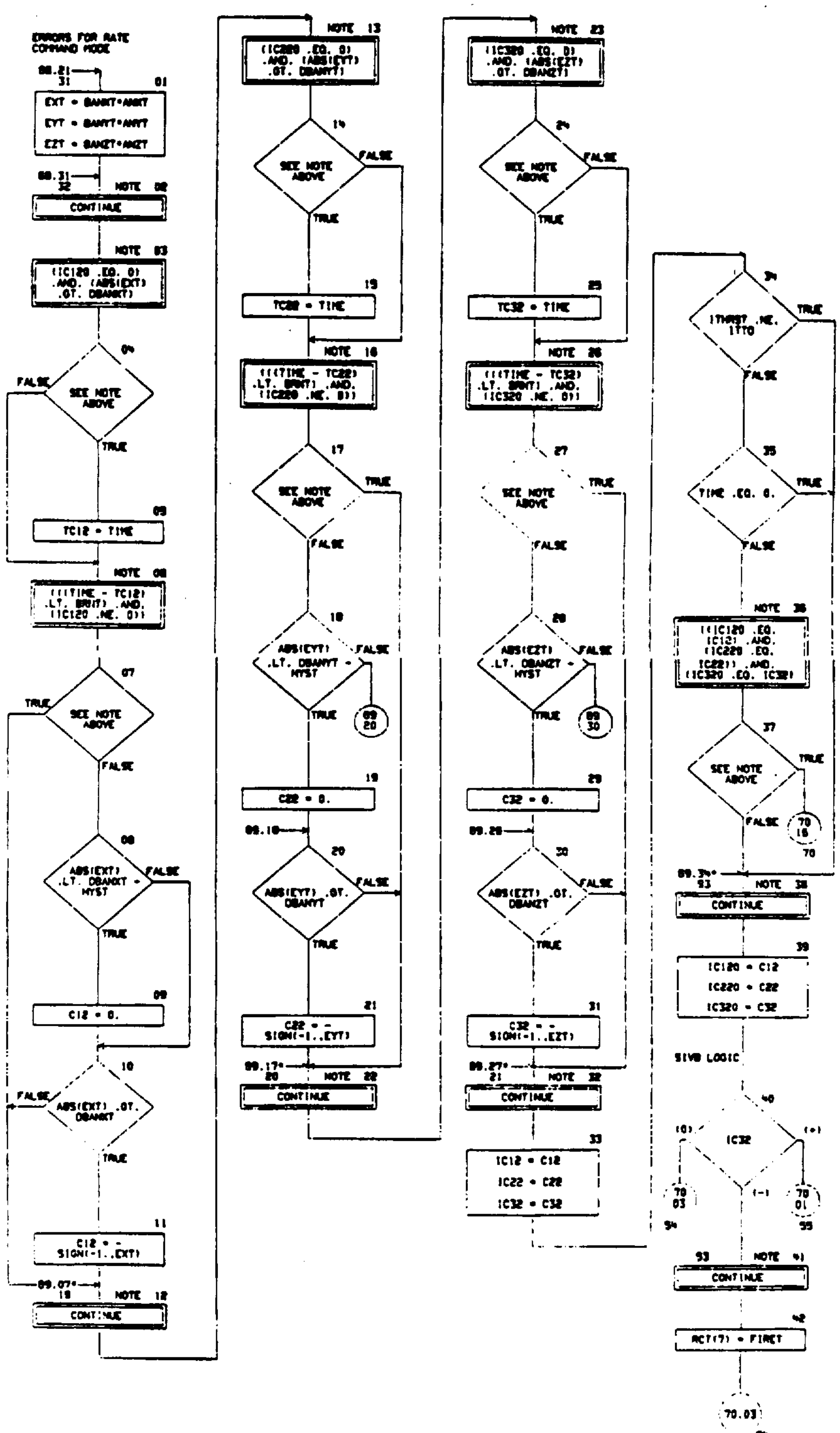

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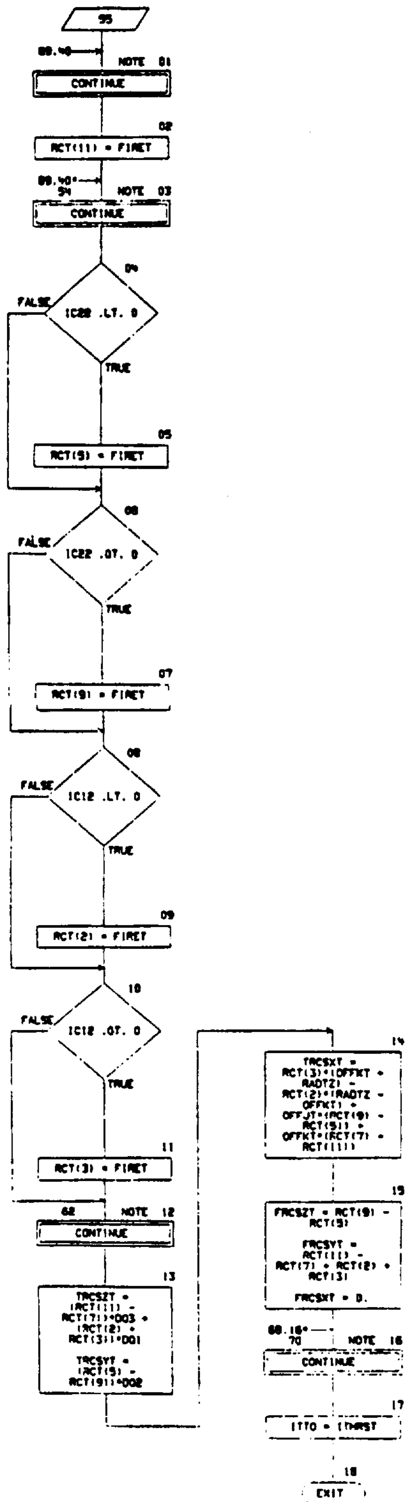
CHART TITLE - SUBROUTINE RCS



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Space Division
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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
      DIMENSION VAR(2400),T(2000),A(15),B(15),C(50),D(30),E(15),F(10),
     AA(25),AT(30),CO(10),SB(10)
     ,CONST(3)
     .    RCA(10),RCT(10),S(2000),ADD(100)
      EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
     (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
     (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
     (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
     (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
     (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
     (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
     (T(29),YTD),(T(30),ZTD)
      EQUIVALENCE (A(2),XMA),(A(3),XXIA),(A(4),YYIA),(A(5),ZZIA),
     (A(6),XYIA),(A(7),XZIA), (A(8),YZIA),(A(9),OFFJA),
     (A(10),OFFKA),(A(11),RA)
      EQUIVALENCE (B(2),XMT),(B(3),XXIT),(B(4),YYIT),(B(5),ZZIT),
     (B(6),XYIT),(B(7),XZIT),(B(8),YZIT),(B(9),OFFJT),
     (B(10),OFFKT),(B(11),RT)
      EQUIVALENCE (C(2),TIP),(C(3),BC),(C(4),ARML1),(C(5),PA),
     (C(6),XLST),(C(7),BT),(C(8),SA),(C(9),PB),(C(10),XLCS)
     ,(C(11),BD),(C(12),XL1),(C(13),PC),(C(14),XLCB),
     (C(15),XAS),(C(16),XL2),(C(17),DA),(C(18),DL)
     ,(C(19),THCRO),(C(20),XMISS)
     ,(ZETA,C(21)),(TARM,C(22))
      EQUIVALENCE (D(2),PREPR),(D(3),CSTOP),(D(4),DMU),(D(5),ORIF),
     (D(6),PRESH),(D(7),STOPPR),(D(8),FCONB),(D(9),CAD1),
     (D(10),CK1),(D(11),STOPSH),(D(12),PMU),(D(13),FULPRE),
     (D(14),CAK1),(D(15),E11),(D(16),E12),(D(17),FCONP)
     ,(D(18),ADMU)
      EQUIVALENCE (E(2),IPHASE),(E(3),STOP),(E(4),IPLOT),(E(5),ITABLE),
     (E(6),IGRAPH),(E(7),DELP),(E(8),DESLC),(E(9),JN),
     (E(10),ICASE)
      EQUIVALENCE (F(2),THESH),(F(3),N),(F(4),A3),(F(5),A5),(F(6),KA1),
     (F(7),A2),(F(8),A4),(F(9),A7)
      EQUIVALENCE (AA(2),THCOMA),(AA(3),PHCOMA),(AA(4),PSCOMA),
     (AA(5),ARXA),(AA(6),ARYA),(AA(7),ARZA),(AA(8),AOPHA),
     (AA(9),AOTHA),(AA(10),AOPSA),(AA(11),RADA),
     (AA(12),FIREA),(AA(13), BRNA),(AA(14),DBANXA),
     (AA(15),DBANYA),(AA(16),DBANZA),(AA(17),TIMEA),
     (AA(18),REACTA),(AA(19),BANXA),(AA(20),BANYA),
     (AA(21),BANZA),(AA(22),IR)
     ,(AA(23),RMAXA),(AA(24),PMAXA),(AA(25),YMAXA)
      EQUIVALENCE (AT(2),RADTY),(AT(3),RADTZ),(AT(4),FIRET),(AT(5),BRNT)
     ,(AT(6),ARXT),(AT(7),ARYT),(AT(8),ARZT),(AT(9),AOPHT),
     (AT(10),AOTHT),(AT(11),AOPST),(AT(12),DBANXT),
     (AT(13),DBANYT),(AT(14),DBANZT),(AT(15),THCONT),
     (AT(16),PHCONT),(AT(17),PSCONT),(AT(18),REACTT),
     (AT(19),BANXT),(AT(20),BANYT),(AT(21),BANZT),
     (AT(22),DO1),(AT(23),DO2),(AT(24),DO3),(AT(25),TIMET),
     (AT(26),RMAXT),(AT(27),YMAXT),(AT(28),PMAXT),
     (AT(29),IRCS),(AT(30),IVEH)
      EQUIVALENCE (S(1),C11),(S(2),C21),(S(3),C31),(S(4),C12),(S(5),C22)
     ,(S(6),C32),(S(7),TC11),(S(8),TC21),(S(9),TC31),(S(10),TC12),
     (S(11),TC22),(S(12),TC32),(S(13),IC110),(S(14),IC210),(S(15),
     IC310),(S(16),IC120),(S(17),IC220),(S(18),IC320)
     , (S(19),FRCSXA),(S(20),FRCSYA),(S(21),FRCSZA),(S(22),FRCSXT),
     (S(23),FRCSYT),(S(24),FRCSZT),(S(25),TRCSXA),(S(26),TRCSYA),
     (S(27),TRCSZA),(S(28),TRCSXT),(S(29),TRCSYT),(S(30),TRCSZT),
     (S(31),ITHRSA),(S(32),ITHRST),(S(33),IHOLDA),(S(34),IHOLDT)
     ,(S(40),ITAO),(S(41),ITTO)
     ,(ADD(75),HYSA),(ADD(76),HYST)
      EQUIVALENCE (VAR(1),A(1)),(VAR(16),B(1)),(VAR(31),C(1)),
     (VAR(81),D(1)),(VAR(111),E(1)),(VAR(126),F(1)),
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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
          (VAR(138),AA(1)),(VAR(181),AT(1)),(VAR(191),CO(1)),
          (VAR(201),SS(1)),(VAR(211),T(1))
COMMON VAR
COMMON/EFLEX/TIME,DX(150),ADDS(1000)
COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
 GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
 GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
 GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
 GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
 GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
 GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
 GAMP32,GAMP33
COMMON/RECAL/S
COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
 ,PROBEA,TLSA,I1,IKA1,THESH1,CONST
COMMON /LOO/YARM1,YARM2,YARM3,XLCB1,XLCB2,XLCB3
COMMON/CALCU/F0,FC,F1,TOR1,FS1,FS2,FS3,FCR1,FCR2,FCR3,ETA1,
 ETA2,ETA3,FRT1A,FRT2A,FRT3A,TLS1,TLS2,TLS3,FRT1B,FRT2B,FRT3B,
 VELB1,VELB2,VELB3,VELP,FRICP,FRC1,FRC2,FRC3,PROBEL
COMMON/ANGLE/STHA,CTHA,SPHA,CPHA,SPSA,CPSA,
           STHT,CTHT,SPHT,CPHT,SPST,CPST
COMMON/ERR/THAP,PHAP,PSAP,THTP,PHTP,PSTP
COMMON/ADDNEW/ADD
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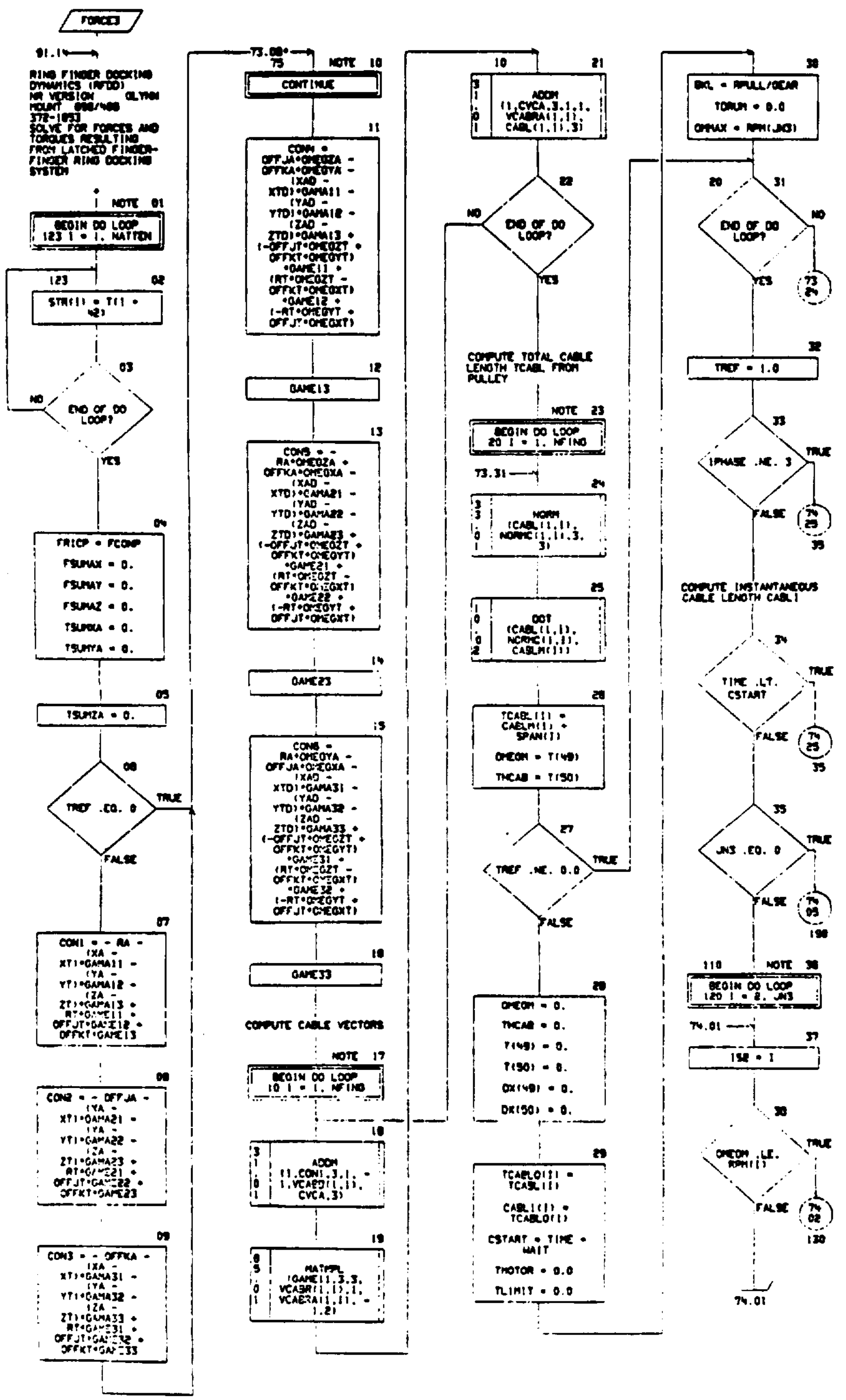
CHART TITLE - SUBROUTINE FORCES



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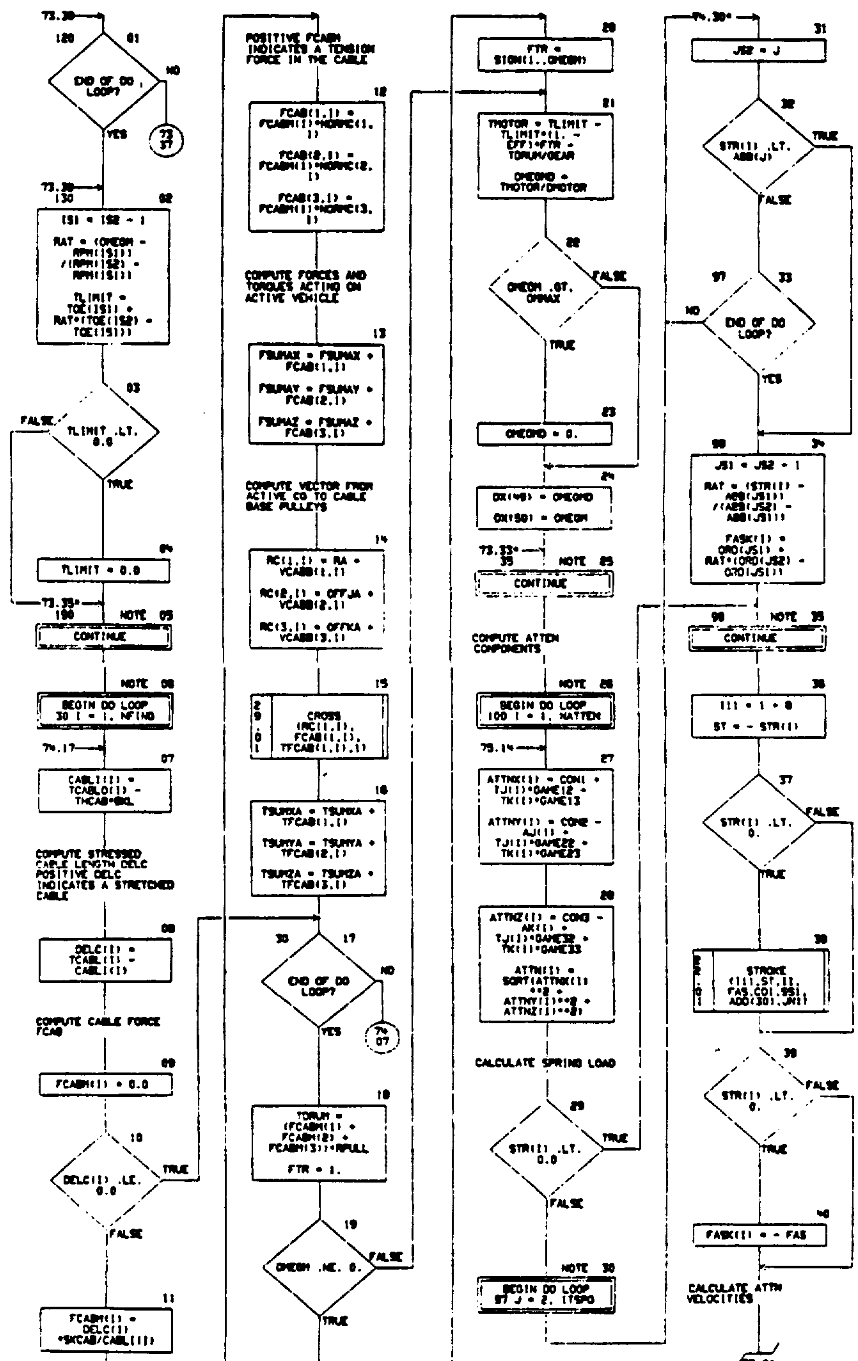
Space Division
Rockwell International

CHART TITLE - SUBROUTINE FORCES



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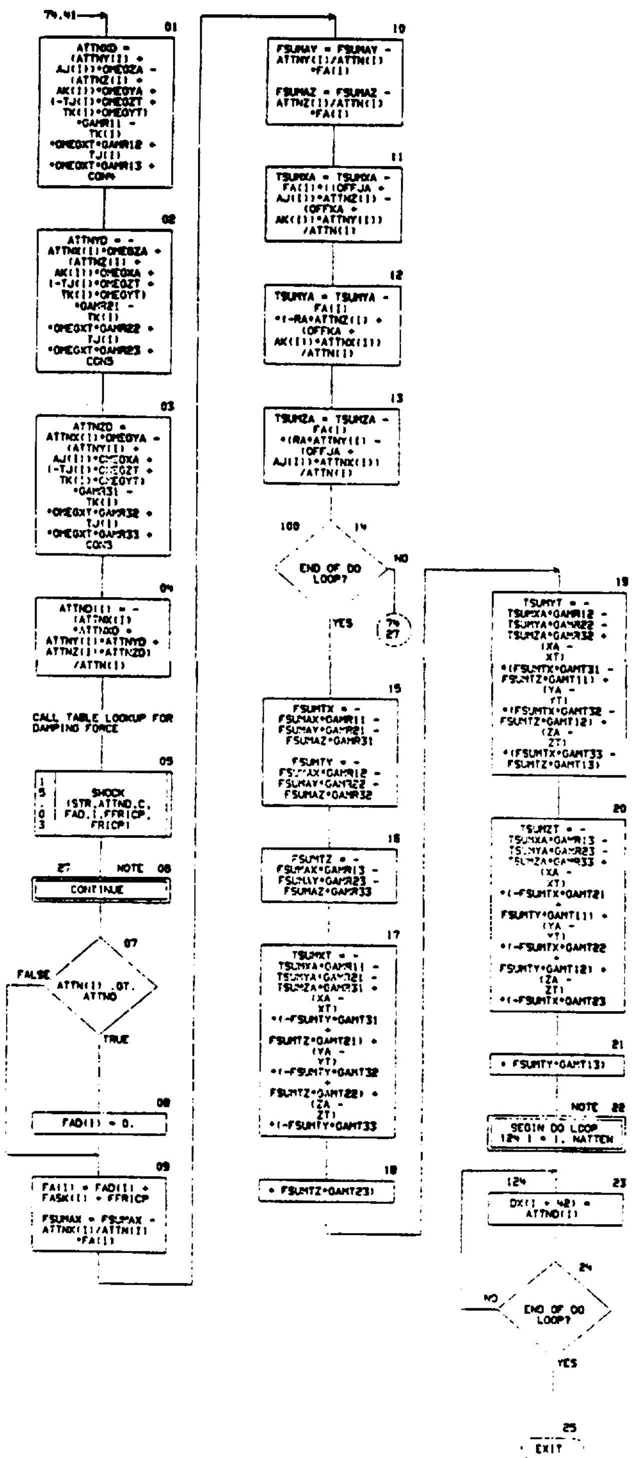
Space Division
Rockwell International



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Space Division
Rockwell International

```
DIMENSION VAR(2400),T(2205),A(15),B(15),C(50),D(30),E(15),F(10),
          AA(25),AT(30),CO(10),SS(10)
          ,ADD(100),COI(10),SSI(10)
DIMENSION ATTNX(20),ATTNY(20),ATTNZ(20),ATTN(20),STR(20),FASK(20)
.ATTNO(20),FAD(20),FA(20),AJ(20),AK(20),TJ(20),TK(20),TH1(20)
 ,TH2(20)
EQUIVALENCE (C(1),NATTEN),(C(2),DA),(C(3),DT),(C(4),ALPHA)
.(C(8),THMA),(C(9),PRELD1),(C(10),DELPRE),(C(11),BRATE)
.(C(12),A1),(C(13),B1),(C(14),C1),(C(15),EXRATE),(C(18),FCOMP)
.          (C(18),F1),(C(21),EM),(C(22),VO),(C(23),BYZ),(C(24),AO)
EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
            (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
            (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
            (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
            (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
            (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
            (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
            (T(29),YTD),(T(30),ZTD)
           ,(DX(19),XPD),(DX(20),YPD),(DX(21),ZPD),(DX(24),ZDD)
EQUIVALENCE(ADD(70),JN1),(ADD(81),COI(1)),(ADD(91),SSI(1))
EQUIVALENCE (A(2),XMA),(A(3),XXIA),(A(4),YYIA),(A(5),ZZIA),
            (A(6),XYIA),(A(7),XZIA), (A(8),YZIA),(A(9),OFFJA),
            (A(10),OFFKA),(A(11),RA)
EQUIVALENCE (B(2),XMT),(B(3),XXIT),(B(4),YYIT),(B(5),ZZIT),
            (B(6),XYIT),(B(7),XZIT),(B(8),YZIT),(B(9),OFFJT),
            (B(10),OFFKT),(B(11),RT)
EQUIVALENCE (E(2),IPHASE),(E(3),STOP),(E(4),IPLOT),(E(5),ITABLE),
            (E(6),IGRAPH),(E(7),DELP),(E(8),DESLC),(E(9),JN),
            (E(10),ICASE)
EQUIVALENCE (F(2),THESH),(F(3),N),(F(4),A3),(F(5),A5),(F(6),KA1),
            (F(7),A2),(F(8),A4),(F(9),A7)
EQUIVALENCE (VAR(1),A(1)),(VAR(16),B(1)),(VAR(31),C(1)),
            (VAR(81),D(1)),(VAR(111),E(1)),(VAR(126),F(1)),
            (VAR(136),AA(1)),(VAR(161),AT(1)),(VAR(191),CO(1)),
            (VAR(201),SS(1)),(VAR(211),T(1))
EQUIVALENCE(ADD(50),CKD),(ADD(51),SHID),(ADD(52),AOC),(ADD(53),ACO
N),(ADD(54),R),(ADD(55),HCO)
COMMON VAR
COMMON/CFLEX/TIME,DX(150),ADDS(1000)
DIMENSION CONT(15,20)
EQUIVALENCE (ADDS(1),CONT(1,1))
COMMON/ADDNEW/ADD
COMMON /ADDLF/ ALF(75)
DIMENSION ABB(10),ORD(10),SS2(10),CO2(10),RPM(15),TQE(15)
EQUIVALENCE (ALF(01),ABB(1)),(ALF(11),ORD(1)),
            (ALF(21),SS2(1)),(ALF(31),CO2(1)),
            (ALF(45),RPM(1)),(ALF(60),TQE(1)),
            (ALF(41),ITSPB), (ALF(42),JN2),
            (ALF(43),JN3)
COMMON/ATTACH/AJ,AK,TJ,TK,FA,ATTNO,STR,ATTN,TH1,TH2,ATTNO
.ATTNX,ATTNY,ATTNZ
COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
 GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
 GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
 GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
 GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
 GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
 GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
 GAMP32,GAMP33
.GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
.PROBCA,TLSA,II,IKA1,THESH1,CONST
COMMON/CALCU/F0,FC,F1,TOR1,FS1,FS2,FS3,FCR1,FCR2,FCR3,ETA1,
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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      ETA2,ETA3,FRT1A,FRT2A,FRT3A,TLS1,TLS2,TLS3,FRT1B,FRT2B,FRT3B,
      VELB1,VELB2,VELB3,VELP,FRICP,FRC1,FRC2,FRC3,PROBEL
     COMMON/FORC/FSUMAX,FSUMAY,FSUMAZ,TSUMXA,TSUMYA,TSUMZA,TSUMXT,
      TSUMYT,TSUMZT,FSUMTX,FSUMTY,FSUMTZ
     COMMON /LOG/YARM1,YARM2,YARM3,XLCB1,XLCB2,XLCB3
     COMMON/OUT/FOX,FOY,FOZ,TORX,TORY,TORZ,STRB1,STRB2,STRB3,STRPR,
           FCX,FCY,FCZ
     COMMON/LATCH/ALATCH(3,4),CLATCH(3,20)
     DIMENSION D(20,6)
     EQUIVALENCE(ADD(8),NFINO)
     . (D(6),SPAN(1)),(D(15),OMEGM),(D(16),RPULL),
       (D(18),SKCAB),(D(19),WAIT)
     . (D(23),TREF)
     . (D(24),EFF),(D(25),GEAR),(D(28),DMOTOR)
     EQUIVALENCE(C(25),GAMA),(C(18),RATIO)
     COMMON/DROGU/ETA,YDC,ZDC
     COMMON/PULL/RETRAC
     COMMON/HARDFT/HARDXA,HARDYA,HARDZA,THRXA,THRYA,THRZA
     COMMON/DVIEW/CON1,CON2,CON3,CTR(3,40),CTRT(3,20)
     COMMON /CA/ VCABR(3,10),VCABB(3,10),CABL(3,10),FCAB(3,10),
                 TMOTOR,FCABM(10)
     REAL*4 NORMC
     DIMENSION CVCA(3),CABLM(10),SPAN(10),NORMC(3,10),
        CABL1(10),DELC(10),RC(3,10),TFCAB(3,10),
        TCABL(10),TCABLO(10),VCABRA(3,10)
     COMMON/RECAL/S(2265)
     EQUIVALENCE(S(61),TDRUM)
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CHART TITLE - SUBROUTINE GRID(IXL,IXR,IYT,IYB,XL,XR,YB,YT)

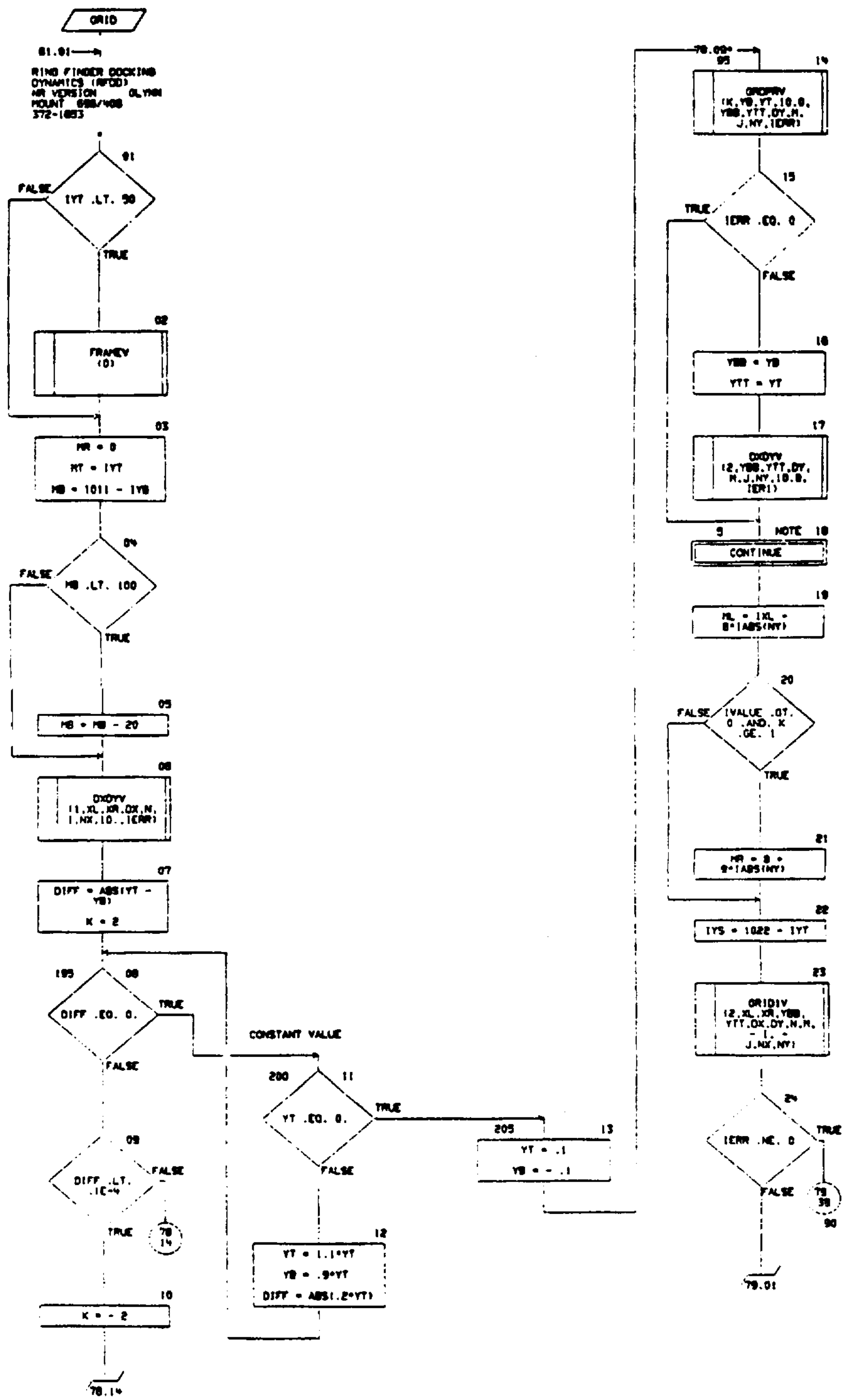

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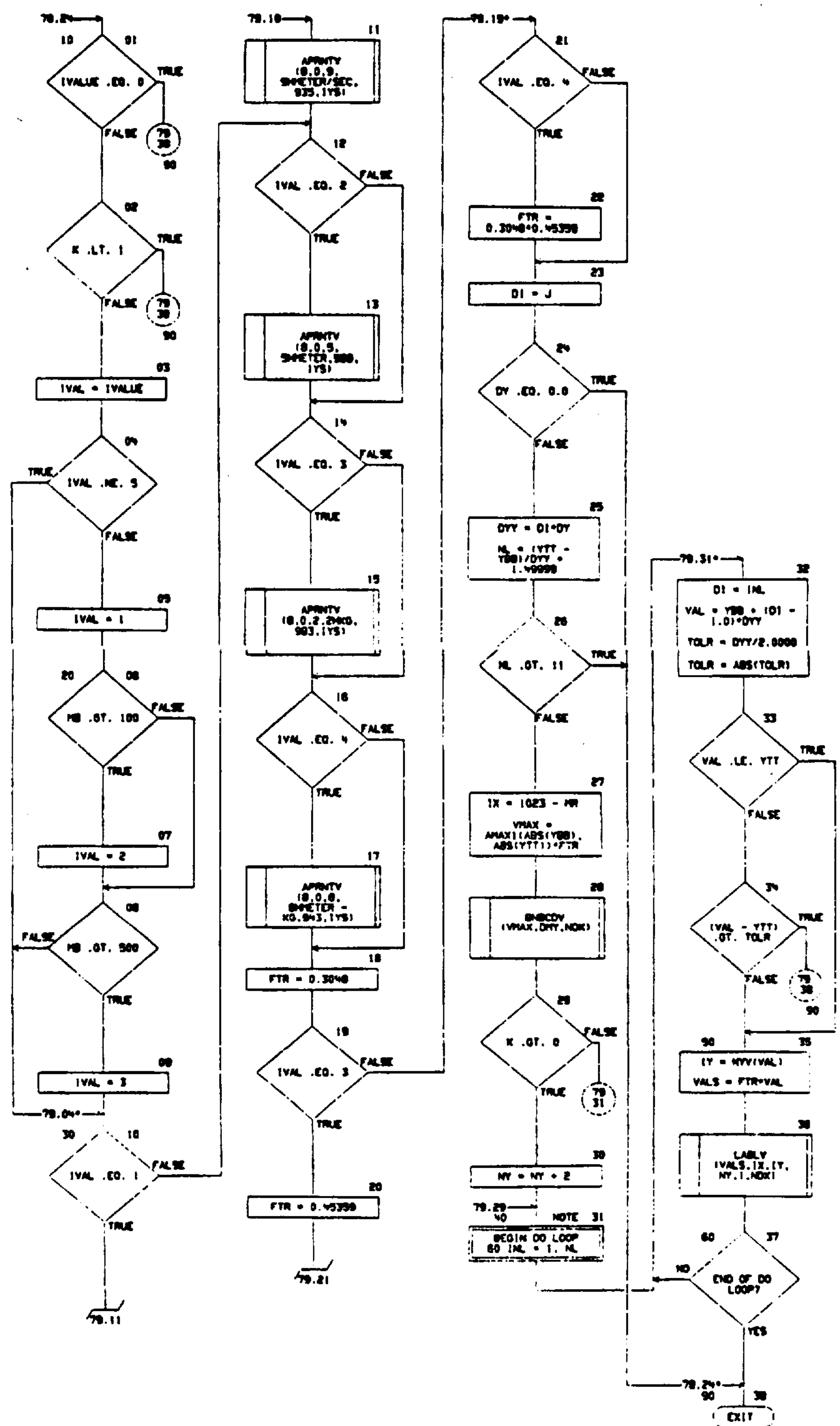
CHART TITLE - SUBROUTINE GRID(IXL,IXR,IYT,IYB,XL,XR,YB,YT)



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SD 74-CS-0023

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
REAL*8 DMY
COMMON /SHRCRT/IV(50)
EQUIVALENCE (IV(17),ML),(IV(18),MB),(IV(19),MR),(IV(20),MT)
COMMON /COS/ IVALUE
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05/22/74 AU⁻⁻ON CHART SET - RFDD.FLO RFDD-FLOW PAGE 92

CHART TITLE - NON-PROCEDURAL STATEMENTS

DIMENSION SCD(1)

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CHART TITLE - NON-PROCEDURAL STATEMENTS

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DIMENSION BCD(1)
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CHART TITLE - SUBROUTINE MATMPL(A,N,M,B,L,C,KA,KB)

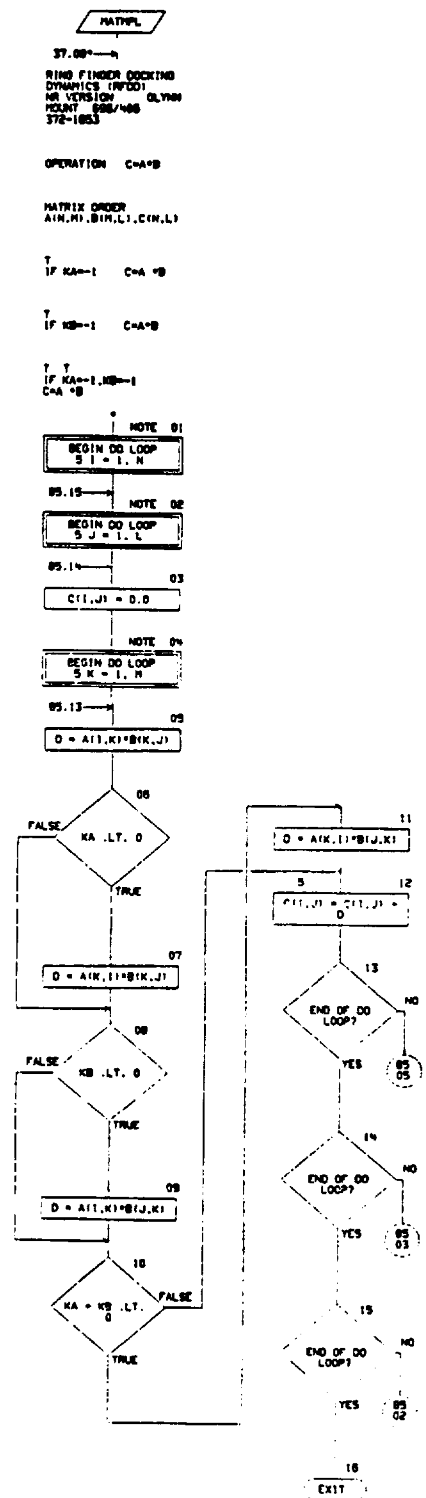

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CHART TITLE - NON-PROCEDURAL STATEMENTS

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DIMENSION A(N,M),B(M,L),C(N,L)
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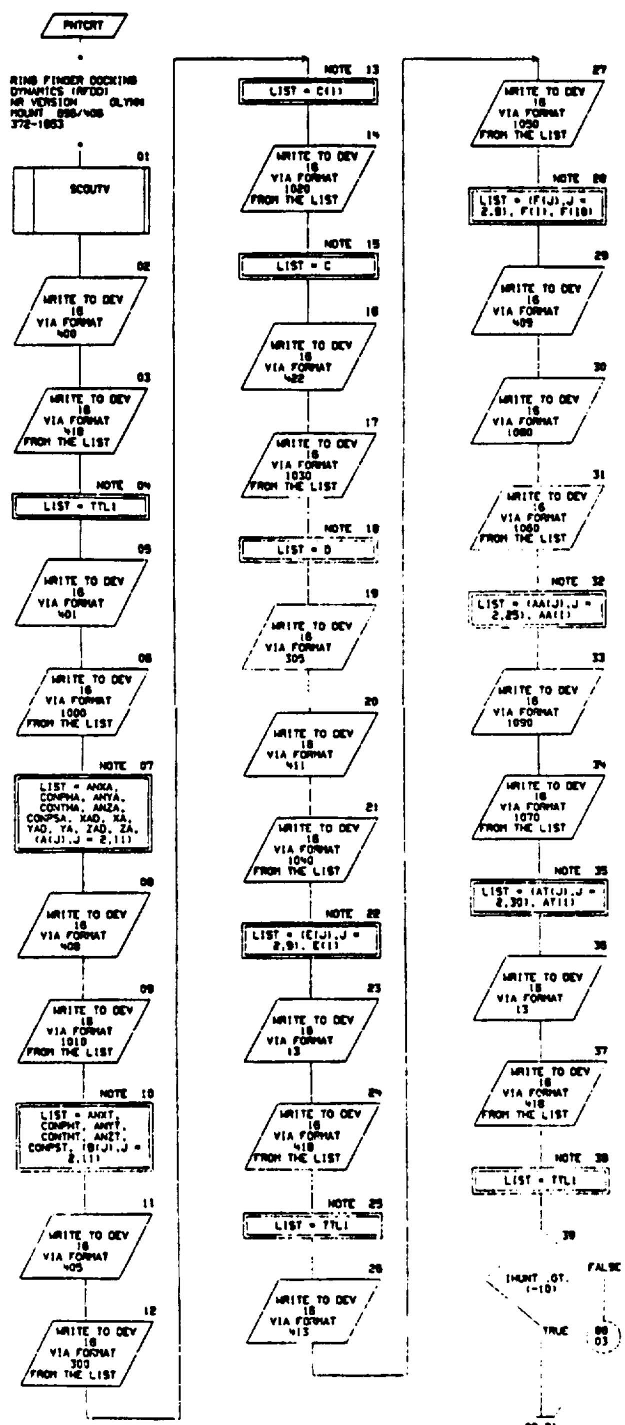
CHART TITLE - SUBROUTINE PNTCRT



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Space Division
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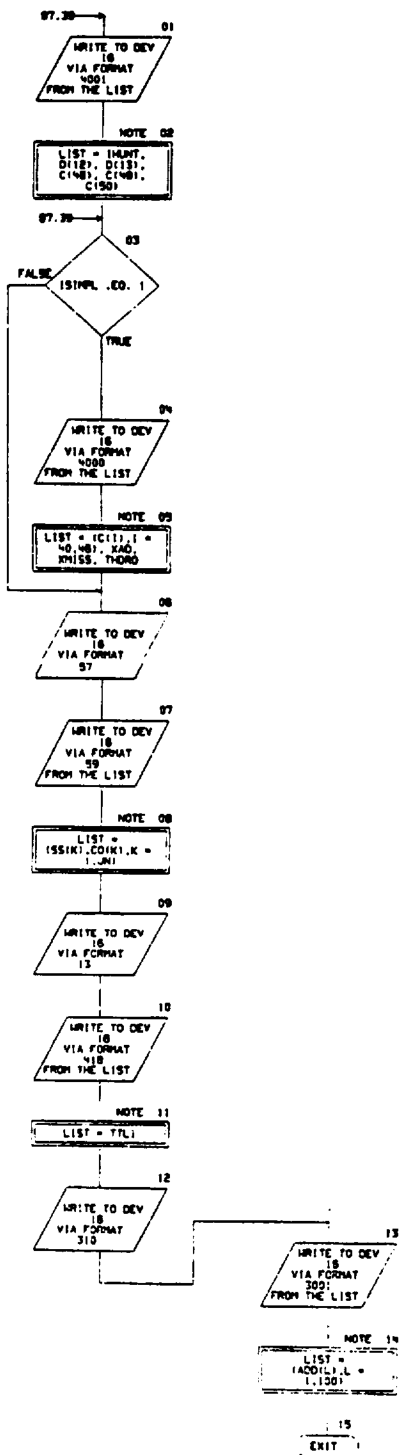
CHART TITLE - SUBROUTINE FNTCRT



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```
      DIMENSION VAR(2400),T(2205),A(15),B(15),C(50),D(30),E(15),F(10),
               AA(25),AT(30),CO(10),SS(10)
      COMMON VAR
      EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),
                  (D(14),INUNT),(C(47),ISIMPL),
                  (T(25),XAD),(T(26),YAD),(T(27),ZAD),
                  (E(9),JM), (C(19),THORO),(C(20),XMISS)
      EQUIVALENCE (VAR(1),A(1)),(VAR(16),B(1)),(VAR(31),C(1)),
                  (VAR(81),D(1)),(VAR(111),E(1)),(VAR(126),F(1)),
                  (VAR(136),AA(1)),(VAR(161),AT(1)),(VAR(191),CO(1)),
                  (VAR(201),SS(1)),(VAR(211),T(1))
      COMMON/ADDNEW/ADD(100)
      REAL*8 TTL1,TTL2
      COMMON /TITLES/ TTL1(8),TTL2(8)
      COMMON /DUMMY/ ANXA,ANYA,ANZA,COMPHA,CONTHA,COMPSA,
                    ANXT,ANYT,ANZT,COMPHT,CONTHT,COMPST
13    FORMAT(1H1)
97    FORMAT(///,53X,' STROKE VS AREA TABLES '// )
98    FORMAT(47XE15.8,5X,E15.8)
300   FORMAT(58X    ,' NO ATTENUATORS =',I3,// )
305   FORMAT(1H ,//)
310   FORMAT(30X,'***** ADD - ARRAY ****  ',//)
400   FORMAT(1H1,//,50X,30H **** INITIAL CONDITIONS ****  )
401   FORMAT(50X,15H ACTIVE VEHICLE//)
405   FORMAT(50X,' C-ARRAY/ ATTENUATOR DATA '// )
408   FORMAT(50X,15H TARGET VEHICLE//)
409   FORMAT(45X,24H REACTION CONTROL SYSTEM//)
411   FORMAT(50X,17H PROGRAM COMMANDS//)
413   FORMAT(50X,17H INTEGRATION DATA//)
418   FORMAT(50X,14H      CASE NO.6A8//)
422   FORMAT(1H ,//,50X,'  D - ARRAY '// )
1000  FORMAT(7X7HOMEGXA E16.8,7X3HPHA4XE16.8,7X8HOMEGYA1XE16.8,7X3HTHA4X
     E16.8/7X8HOMEGZA1XE16.8,7X3HPSA4XE16.8,7X3HXAD4XE16.8,7X2HXAS5XE16.
     8/7X3HYAD4XE16.8,7X2HYAS5XE16.8,7X3HZAD4XE16.8,7X2HZAS5XE16.8/7X3HOM
     A4XE16.8,7X4HXXIA3XE16.8,7X4HYYIA3XE16.8,7X4HZZIA3XE16.8/7X4HXYIA3
     XE16.8,7X4HXZIA3XE16.8,7X4HYZIA3XE16.8,7X5HOFFJA2XE16.8/7X5HOFFKA2
      XE16.8,7X2HRA5XE16.8///)
1010  FORMAT(7X8HOMEGXT1XE16.8,7X3HPHT4XE16.8,7X8HOMEGYT1XE16.8,7X3HTHT4
     XE16.8/7X8HOMEGZT1XE16.8,7X3HPST4XE16.8,7X3HOMT4XE16.8,7X4HXXIT3XE
     16.8/7X4HYYIT3XE16.8,7X4HZZIT3XE16.8,7X4HXYIT3XE16.8, 7X7HXZIT   E
     16.8/7X4HYZIT3XE16.8,7X5HOFFJT2XE16.8,7X5HOFFKT2XE16.8,7X2HRT5XE16
     .8///)
1020  FORMAT(1H ,8E15.8)
1030  FORMAT(1H ,8E15.8)
1040  FORMAT(7X,7HIPHASE I16,7X4HSTOP3XE16.8,7X7HDELPP  E16.8,7X4HCASE3X
     E16.8/ 7X7HIGRAPH I16,7X4HDELP3XE16.8,7X7HDESLC  E16.8,
      7X2HJM5XI16/
     7X5HPLOT2XI16///)
1050  FORMAT(7X7HTMESH  E16.8,7X1HNBXI16,7X2HA35XE16.8,7X2HA55XE16.8/
      7X3HKA14XI16,7X2HA25XE16.8,7X2HA45XE16.8,7X2HA75XE16.8/
     7X3HAZA4XE16.8,7X3HAAA4XE16.8///)
1060  FORMAT(7X7HTHCOMA E16.8,7X7HPHCOMA E16.8,7X7HPSCOMA E16.8,7X4HARXA
     3XE16.8/7X4HARYA3XE16.8,7X4HARZA3XE16.8,7X5HADPHA2XE16.8,7X5HADTHA
     2XE16.8/ 7X5HADPSA2XE16.8,7X3HFDA4XE16.8,7X3HFRA4XE16.8,7X3HBRA4XE
     16.8/7X7HOBANXA E16.8,7X7HOBANYA E16.8,7X7HOBANZA E16.8,7X3HTHA4XE
     16.8/7X7HREACTA E16.8,7X5HBANXA2XE16.8,7X5HBANYA2XE16.8,7X5HBANZA2
     XE16.8/7X2HIRSXI16  ,7X5HRMAXA2XE16.8,7X5HYMAXA2XE16.8,7X5HPMAXA2X
     E16.8/7X7HREACTIAE16.8///)
1070  FORMAT(7X5HRADTY2XE16.8,7X4HROTZ3XE16.8,7X5HFIRET2XE16.8,7X3HBRT4X
     E16.8/7X4HARXT3XE16.8,7X4HARYT3XE16.8,7X4HARZT3XE16.8,7X5HADPHT2XE
     16.8/7X5HADTHT2XE16.8,7X5HADPST2XE16.8,7X7HOBANXT E16.8,7X7HOBANYT
      E16.8/7X7HOBANZT E16.8,7X7HTHCOMT E16.8,7X7HPHCOMT E16.8,7X7HPSCO
     MT E16.8/7X7HREACTT E16.8,7X7HBANXT  E16.8,7X7HBANYT  E16.8,7X7HBA
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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      NZT  E16.8/7X3HDQ14XE16.8,7X3HDQ24XE16.8,7X3HDQ34XE16.8,7X3HTHT4XE
      16.8/7X5HRMAXT2XE16.8,7X5HYMAXT2XE16.8,7X5HPMAXT2XE16.8,7X4HIRCS3X
      I16/  7X4HIVEH3XI16
      ,7X7HREACTITE16.8///)
1080  FORMAT(45X,24H   ACTIVE CONTROL SYSTEM//)
1090  FORMAT(45X,24H   TARGET CONTROL SYSTEM//)
3001  FORMAT(1H0,8E15.8)
4000  FORMAT(//,46X,31H SIMPLIFIED INITIAL CONDITIONS //,7X5HTHANG2XE16
       .8,7X5HTHTOT2XE16.8,7X5HTHVEL2XE16.8,7X7HVELLAT E16.8/
       7X5HOMEGR2XE16.8,7X5HOMEGT2XE16.8,7X7HTHOMEG E16.8,7X7HVAXIAL
       E16.8/7X7HOOMISS  E16.8,7X7HTHORO  E16.8//)
4001  FORMAT(//,46X,31H STABILITY PARAMETERS OF HUNT  //,7X7HIHUNT  I16,
       7X5HDELTA2XE16.8,7X5HDELTL2XE16.8,7X5HVLMIN2XE16.8/
       7X5HVLMAX2XE16.8,7X5HVAMIN2XE16.8//)
```

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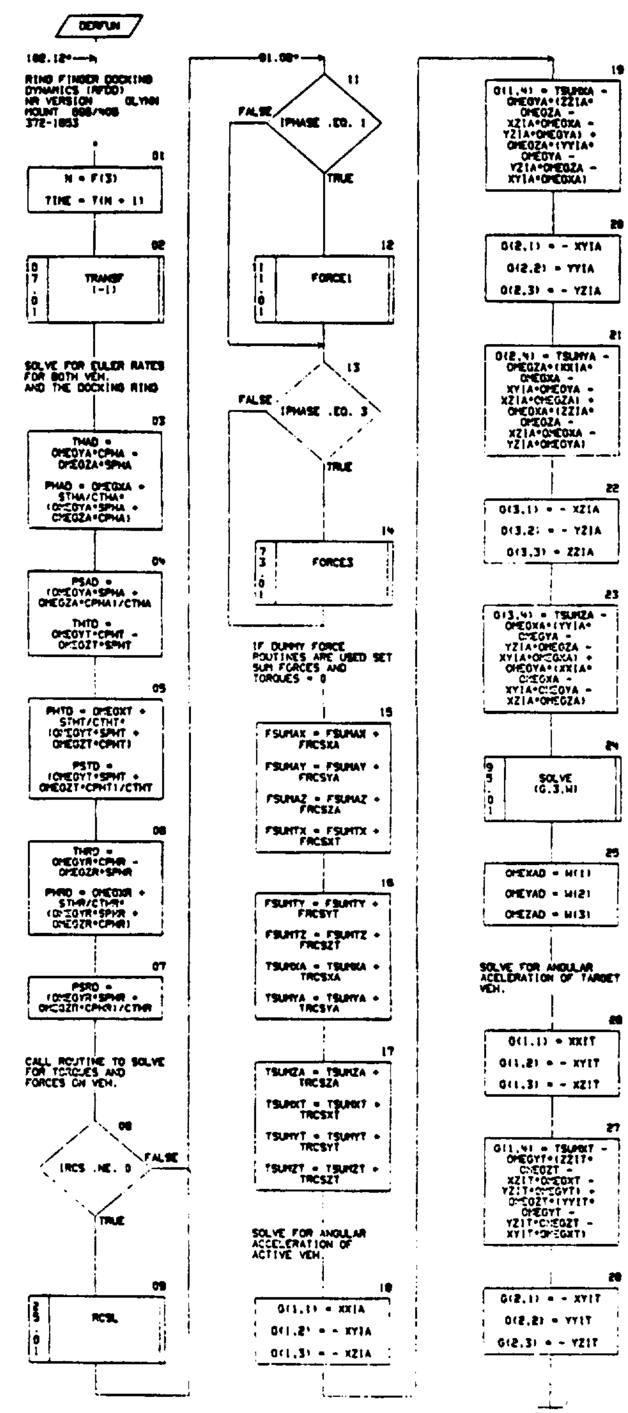
CHART TITLE - SUBROUTINE DERFUN



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SD 74-CS-0023

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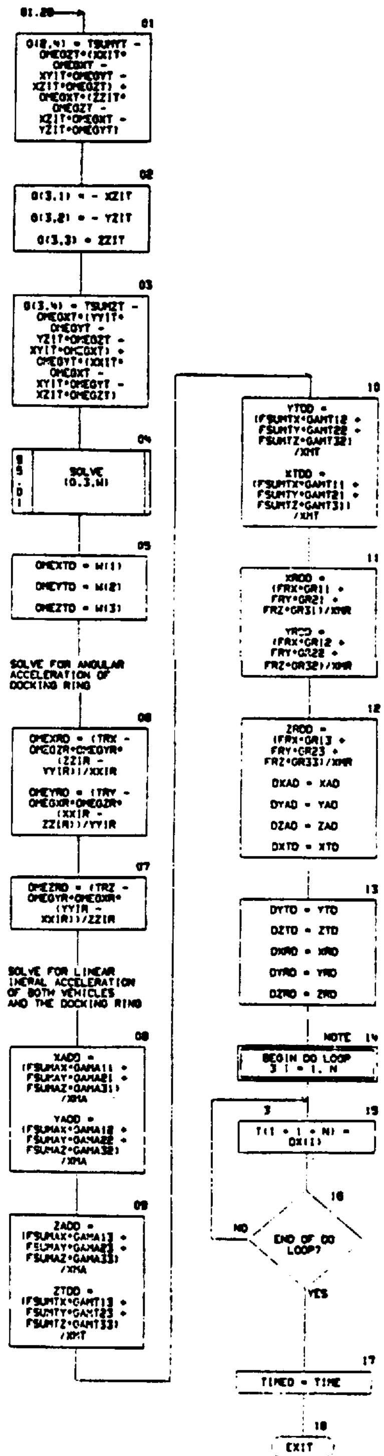
Space Division
Rockwell International

CHART TITLE - SUBROUTINE DERFUN



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Space Division
Rockwell International

CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION VAR(2400),T(2885),A(15),B(15),C(50),D(30),E(15),F(10),
        AA(25),AT(30),CO(10),SS(10)
,G(20,8),M(20)
.          S(2885)
EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
           (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
           (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
           (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
           (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
           (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
           (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
           (T(29),YTD),(T(30),ZTD)
EQUIVALENCE(T(31),XRD),(T(32),YRD),(T(33),ZRD),(T(34),XR),(T(35),
      YR),(T(36),ZR),(T(37),THR),(T(38),PSR),(T(39),PHR),(T(40),
    OMEGXR),(T(41),OMEGYR),(T(42),OMEGZR)
INTEGER F
EQUIVALENCE (DX(1),DXAD),(DX(2),DYAD),(DX(3),DZAD),(DX(4),DXTD),
           (DX(5),DYTD),(DX(6),DZTD),(DX(7),OMEXAD),(DX(8),OMEYAD
           ),(DX(9),OMEZAD),(DX(10),OMEXTD),(DX(11),OMEYTD),
           (DX(12),OMEZTD),(DX(13),THAD),(DX(14),PHAD),
           (DX(15),PSAD),(DX(16),THTD),(DX(17),PHTD),(DX(18),PSTD
           ),(DX(19),XPD),(DX(20),YPD),(DX(21),ZPD)
           ,(DX(24),ZDD),(DX(25),XADD),(DX(26),YADD),
           (DX(27),ZADD),(DX(28),XTDD),(DX(29),YTDD),(DX(30),ZTDD)
EQUIVALENCE(DX(31),XRDD),(DX(32),YRDD),(DX(33),ZRDD),(DX(34),DXRD)
           ,(DX(35),DYRD),(DX(36),DZRD),(DX(37),THRD),(DX(38),PSRD)
           ,(DX(39),PHRD),(DX(40),OMEXRD),(DX(41),OMEYRD)
           ,(DX(42),OMEZRD)
           ,(ADD(4),XMR),(ADD(5),XXIR),(ADD(6),YYIR),(ADD(7),ZZIR)
COMMON/EFLEX/TIME,DX(150),ADD5(1000)
EQUIVALENCE (A(2),XMA),(A(3),XXIA),(A(4),YYIA),(A(5),ZZIA),
            (A(6),XYIA),(A(7),XZIA), (A(8),YZIA),(A(9),OFFJA),
            (A(10),OFFKA),(A(11),RA)
EQUIVALENCE (B(2),XMT),(B(3),XXIT),(B(4),YYIT),(B(5),ZZIT),
            (B(6),XYIT),(B(7),XZIT),(B(8),YZIT),(B(9),OFFJT),
            (B(10),OFFKT),(B(11),RT)
EQUIVALENCE (E(2),IPHASE),(E(3),STOP),(E(4),IPLOT),(E(5),ITABLE),
            (E(6),IGRAPH),(E(7),DELP),(E(8),DESLC),(E(9),JN),
            (E(10),ICASE)
, (S(19),FRCSXA),(S(20),FRCSYA),(S(21),FRCSZA),(S(22),FRCSXT),
 (S(23),FRCSYT),(S(24),FRCSZT),(S(25),TRCSXA),(S(26),TRCSYA),
 (S(27),TRCSZA),(S(28),TRCSXT),(S(29),TRCSYT),(S(30),TRCSZT)
EQUIVALENCE (VAR(1),A(1)),(VAR(16),B(1)),(VAR(31),C(1)),
            (VAR(81),D(1)),(VAR(111),E(1)),(VAR(126),F(1)),
            (VAR(136),AA(1)),(VAR(161),AT(1)),(VAR(191),CO(1)),
            (VAR(201),SS(1)),(VAR(211),T(1))
           ,(AT(29),IRCS)
COMMON VAR
COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
 GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
 GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
 GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
 GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
 GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
 GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
 GAMP32,GAMP33
 ,GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
COMMON/RECAL/S
COMMON/INITAL/ARMI,TIMEPP,IPULL,JTEST4,SLOPE
 ,PROGEA,TLSA,II,IKAI,THESHI,CONST
COMMON/FORC/FSUMAX,FSUMAY,FSUMAZ,TSUMXA,TSUMYA,TSUMZA,TSUMXT,
 TSUMYT,TSUMZT,FSUMTX,FSUMTY,FSUMTZ
COMMON/ANGLE/STHA,CTHA,SPHA,CPHA,SPSA,CPSA,
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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      STHT,CTHT,SPHT,CPHT,SPST,CPST
COMMON /ANGLER/STHR,CTHR,SPHR,CPHR,SPSR,CPSR
COMMON/FORCR/FRX,FRY,FRZ,TRX,TRY,TRZ
COMMON/TRANR/OR11,OR21,OR31,OR12,OR22,OR32,OR13,OR23,OR33
COMMON/ADDNEW/ADD(100)
COMMON/DROGU/ETA,YDC,ZDC
COMMON/HARDFT/HARDXA,HARDYA,HARDZA,THRDXA,THRDYA,THRDZA
COMMON/TIM/TIMEO
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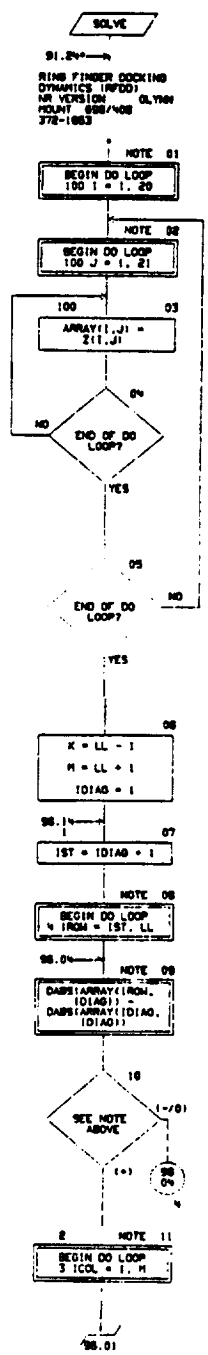
CHART TITLE - SUBROUTINE SOLVE(Z,LL,X)



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Rockwell International

CHART TITLE - SUBROUTINE SOLVE(Z,LL,X)

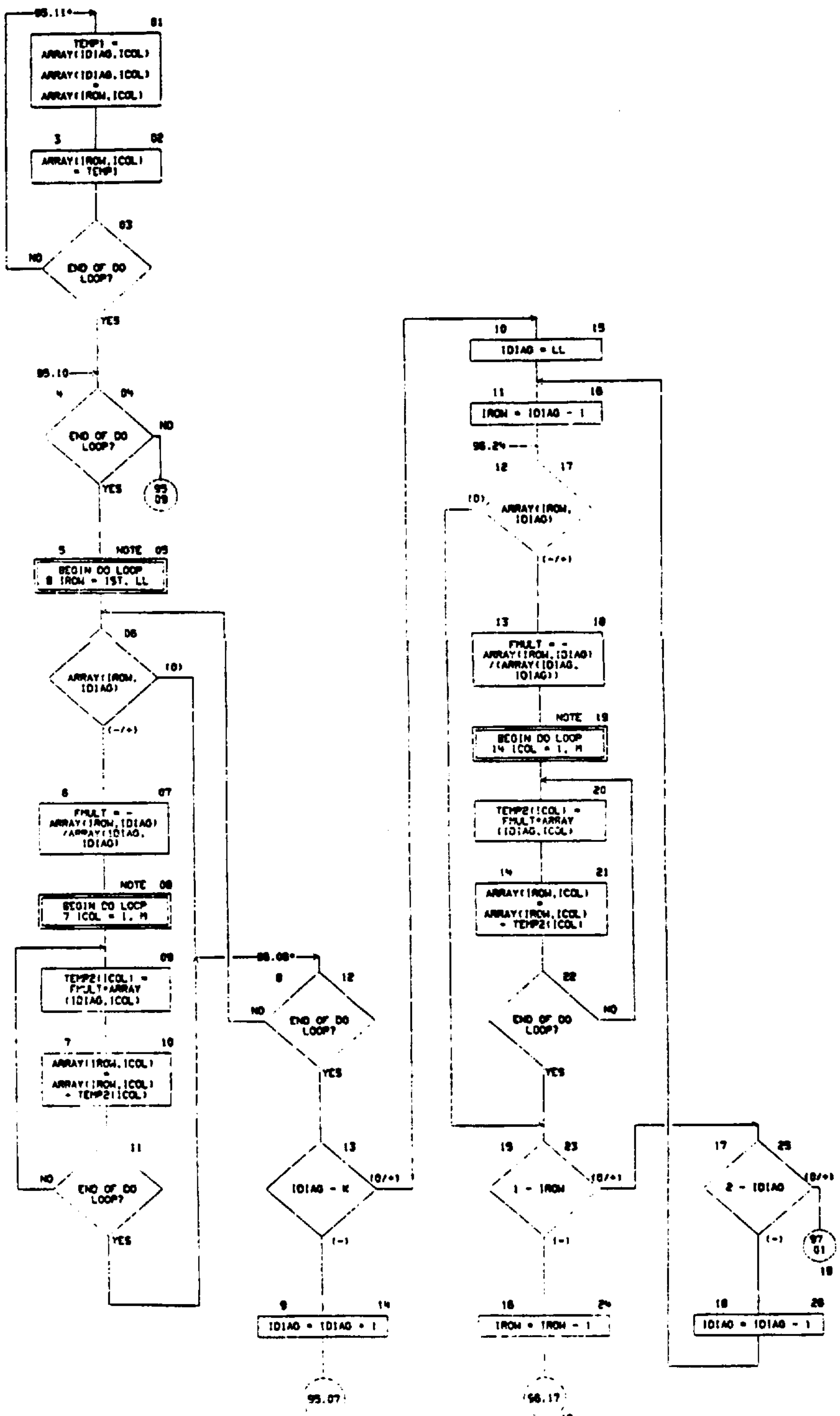

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CHART TITLE - SUBROUTINE SOLVE(Z,LL,X)

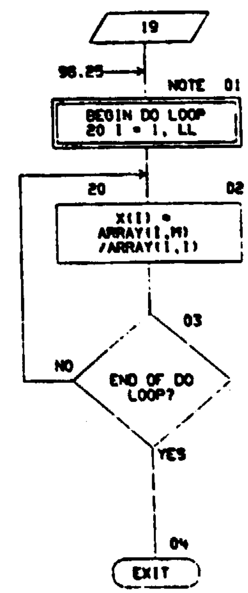

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CHART TITLE - SUBROUTINE MINVSP(A,N,E,K,JB,X,JE,I2,JB,D)

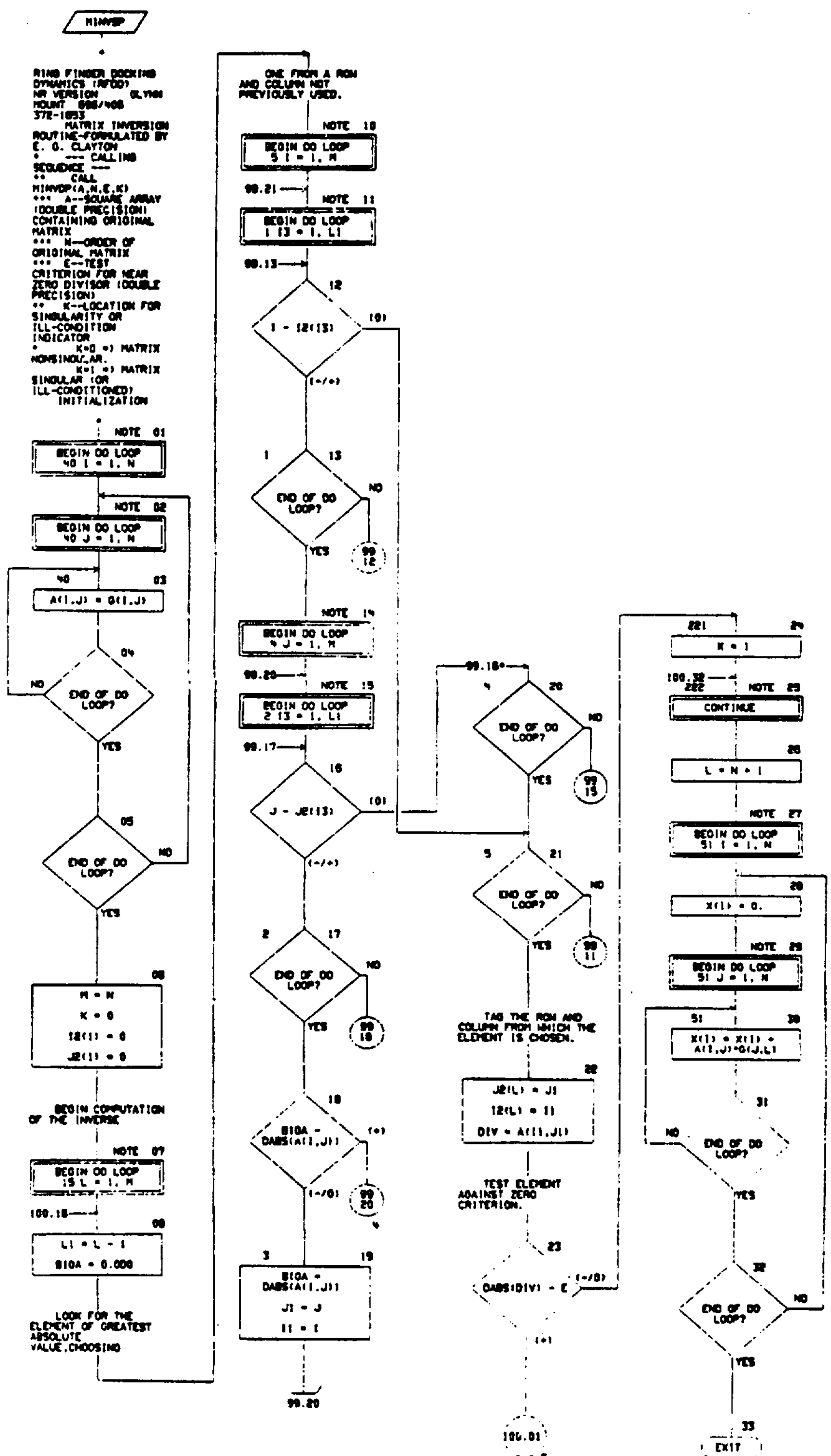

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CHART TITLE - SUBROUTINE MINVSP(A,N,E,K,JB,X,J2,I2,JB,D)

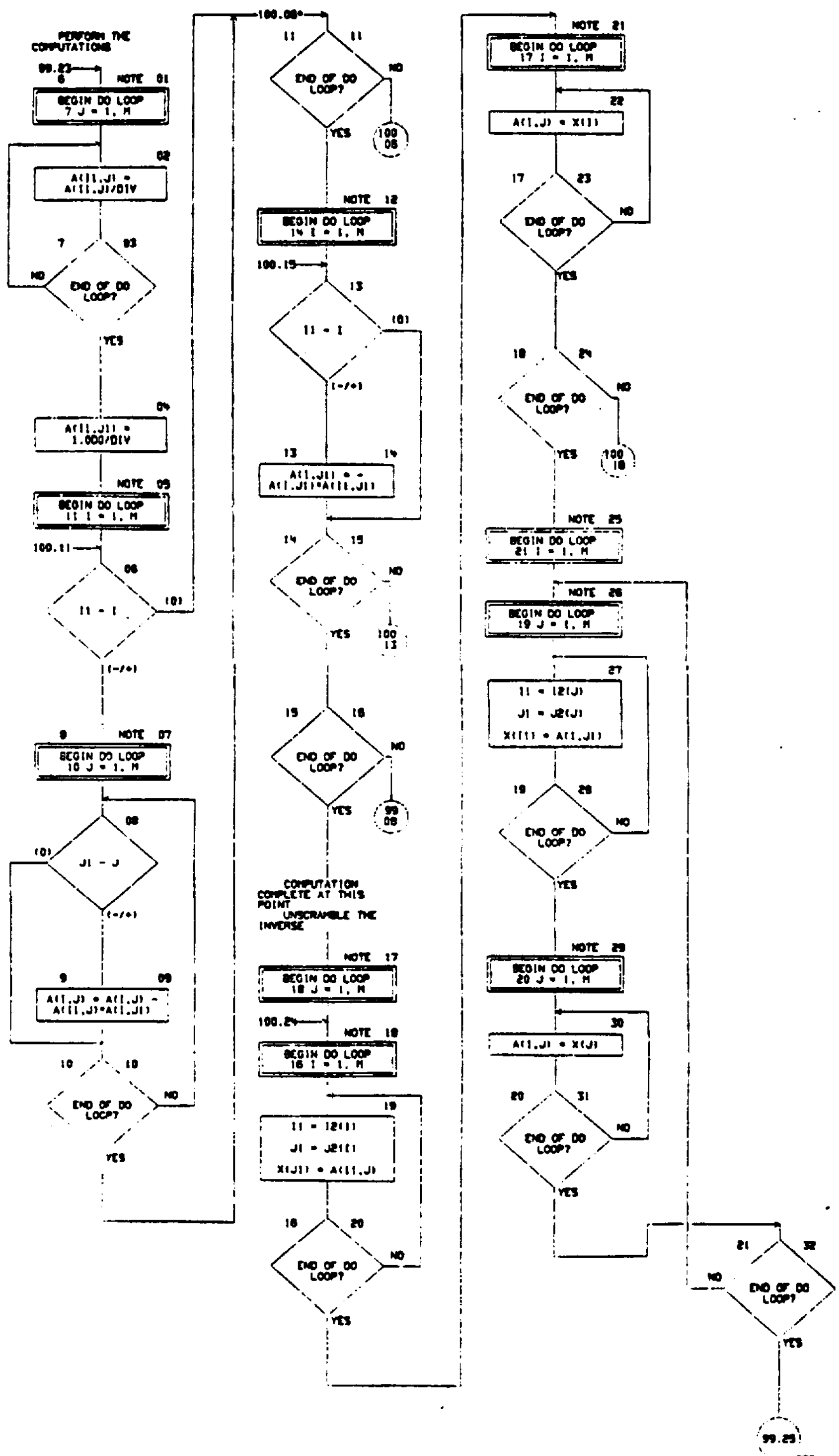

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DOUBLE PRECISION  A,X,BIGA,DIV,E
DIMENSION A(J8,J8),X(J8),J2(J8),I2(J8)
,G(J8,J9),Y(6,6)
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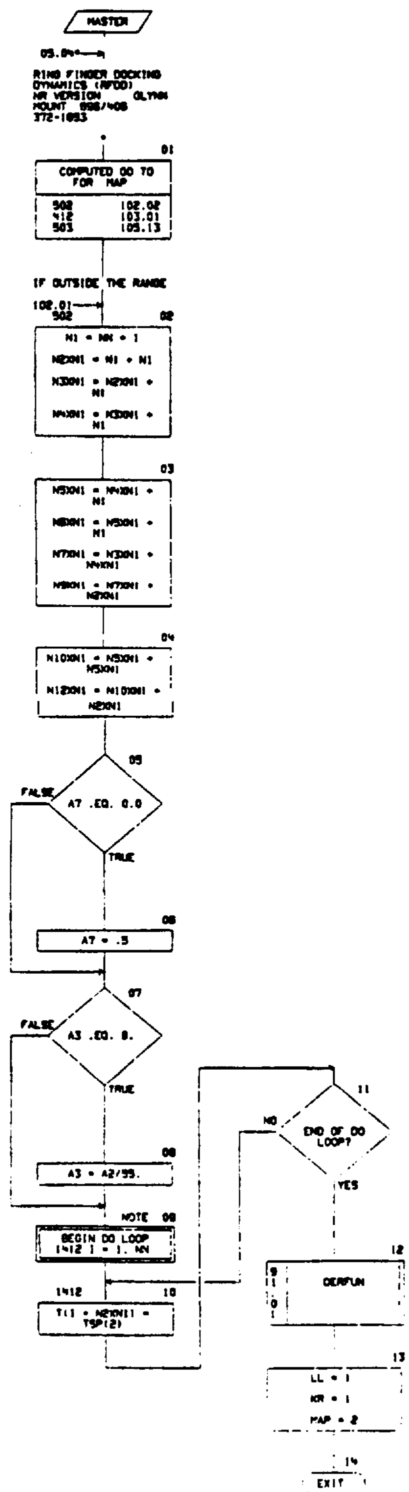
CHART TITLE - SUBROUTINE MASTER



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Space Division
Rockwell International

CHART TITLE - SUBROUTINE MASTER

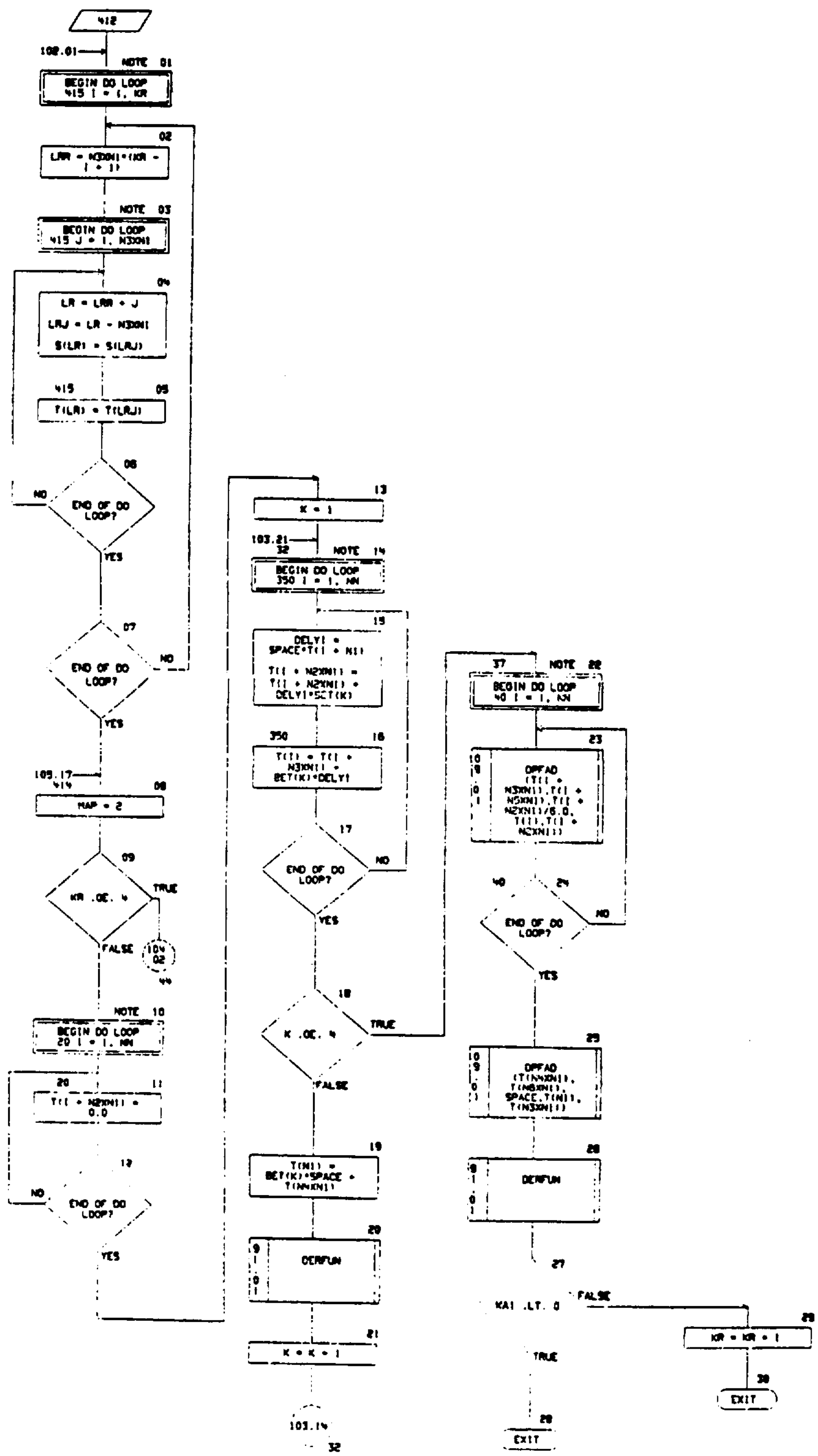

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CHART TITLE - SUBROUTINE MASTER

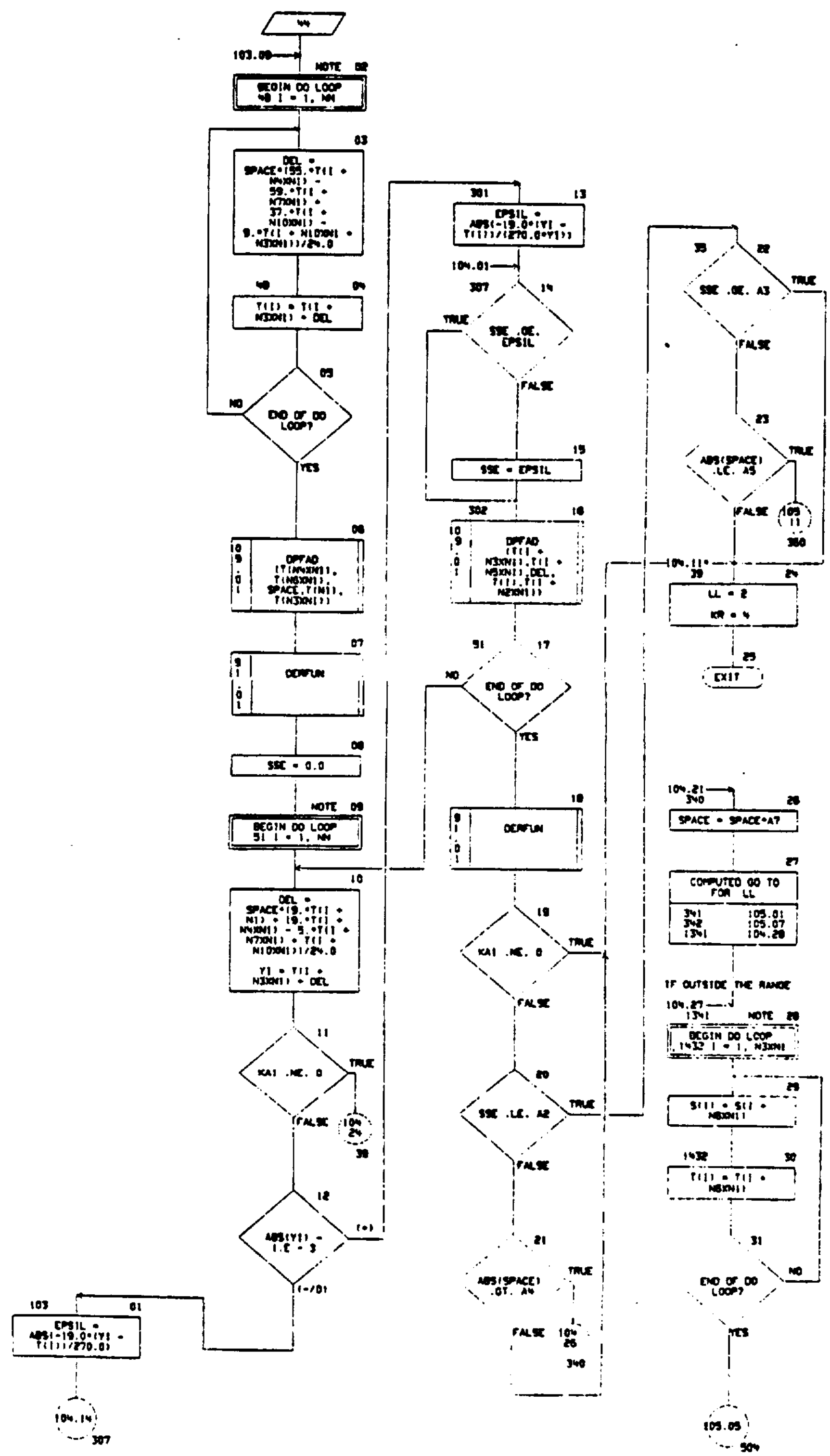

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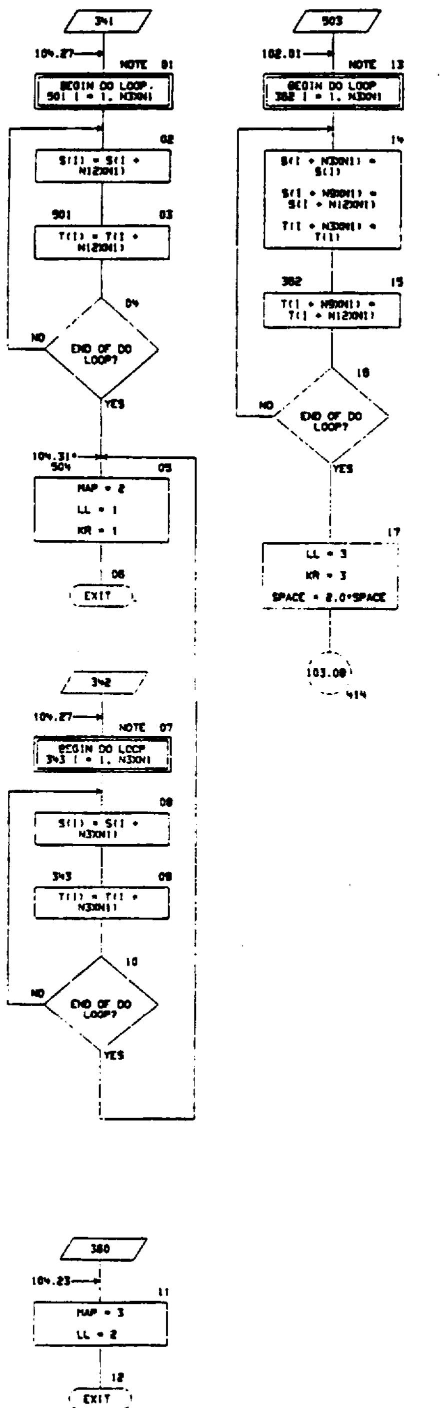
CHART TITLE - SUBROUTINE MASTER



Space Division
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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DIMENSION VAR(2480),T(2285),S(2285),F(10)
DIMENSION BET(4),SET(4)
DIMENSION TSP(2)
DOUBLE PRECISION TOP
EQUIVALENCE (TSP(1),TOP)
EQUIVALENCE (F(2),SPACE),(F(3),NN),(F(4),A3),(F(5),A5),(F(6),KA1),
          (F(7),A2),(F(8),A4),(F(9),A7)
EQUIVALENCE(VAR(211),T(1)),(VAR(126),F(1))
COMMON VAR
COMMON/RECAL/S
COMMON/PP/MAP,LL
COMMON/PP1/KR,K
DATA SET(1)/1.0/,SET(2)/2.0/,SET(3)/2.0/,SET(4)/1.0/
DATA BET(1)/0.5/,BET(2)/0.5/,BET(3)/1.0/,BET(4)/0.0/
DATA TOP/0.D0/
```

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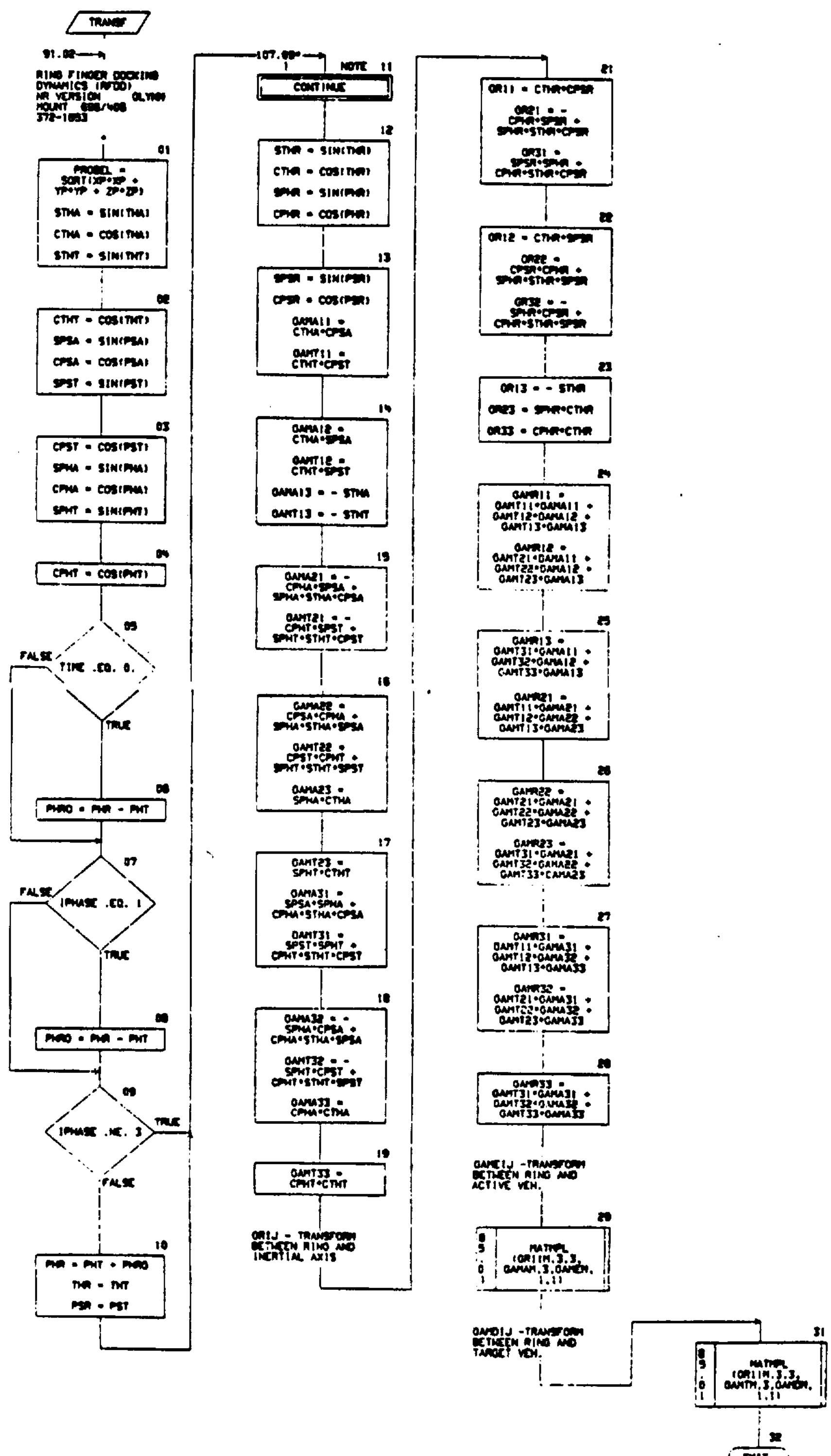
CHART TITLE - SUBROUTINE TRANSF(ITRAN)



Space Division
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DIMENSION GRIIM(3,3),GAMAM(3,3),GAMEM(3,3),GAMDM(3,3),GAMTM(3,3)
EQUIVALENCE (GRIIM(1,1),GR11),(GAMAM(1,1),GAMA11),(GAMEM(1,1),
 GAME11),(GAMDM(1,1),GAMD11),(GAMTM(1,1),GAMT11)
DIMENSION CONST(3)
DIMENSION VAR(2480),T(2265),A(15),B(15),C(50),D(30),E(15),F(10),
         AA(25),AT(30),CO(10),SS(10)
EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
            (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
            (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
            (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
            (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
            (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
            (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
            (T(29),YTD),(T(30),ZTD)
EQUIVALENCE(T(31),XRD),(T(32),YRD),(T(33),ZRD),(T(34),XR),(T(35),
      YR),(T(36),ZR),(T(37),THR),(T(38),PSR),(T(39),PHR),(T(40),
    OMEGXR),(T(41),OMEGYR),(T(42),OMEGZR)
     ,(E(2),IPHASE)
EQUIVALENCE (VAR(1),A(1)),(VAR(16),B(1)),(VAR(31),C(1)),
            (VAR(81),D(1)),(VAR(111),E(1)),(VAR(126),F(1)),
            (VAR(136),AA(1)),(VAR(161),AT(1)),(VAR(191),CO(1)),
            (VAR(201),SS(1)),(VAR(211),T(1))
COMMON VAR
COMMON/EFLEX/TIME,DX(150),ADDS(1000)
COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
 GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
 GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
 GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
 GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
 GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
 GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
 GAMP32,GAMP33
 ,GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
COMMON/ANGLE/STHA,CTHA,SPHA,CPHA,SPSA,CPSA,
            STHT,CTHT,SPHT,CPHT,SPST,CPST
COMMON /ANGLER/STHR,CTHR,SPHR,CPHR,SPSR,CPSR
COMMON/TRANR/GR11,GR21,GR31,GR12,GR22,GR32,GR13,GR23,GR33
COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
```

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CHART TITLE - NON-PROCEDURAL STATEMENTS

```
DOUBLE PRECISION A1,B1,C1
DIMENSION A(6)
EQUIVALENCE (A(1),A1),(A(3),B1),(A(5),C1)
DATA A(4)/0.0/
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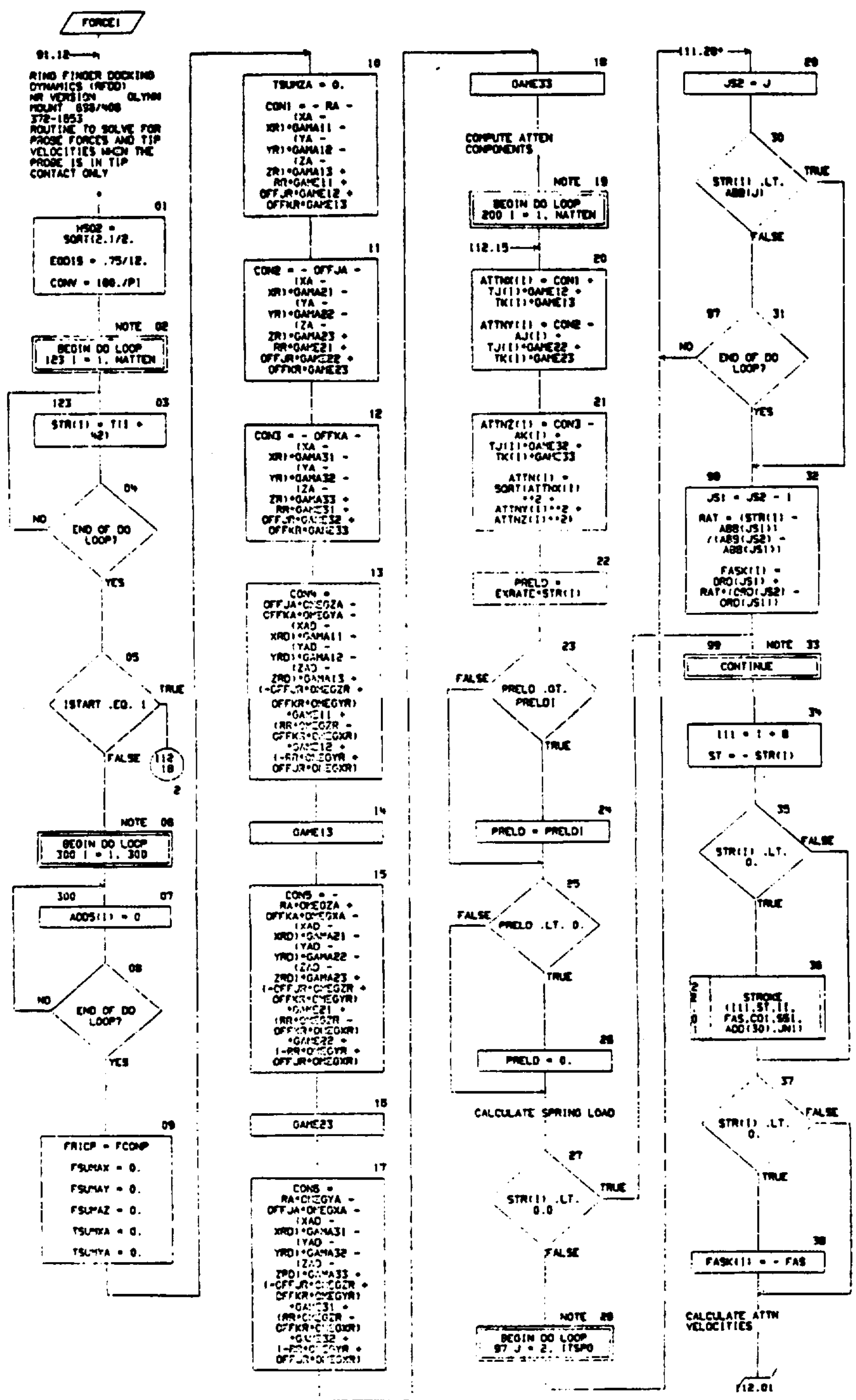
CHART TITLE - SUBROUTINE FORCE1



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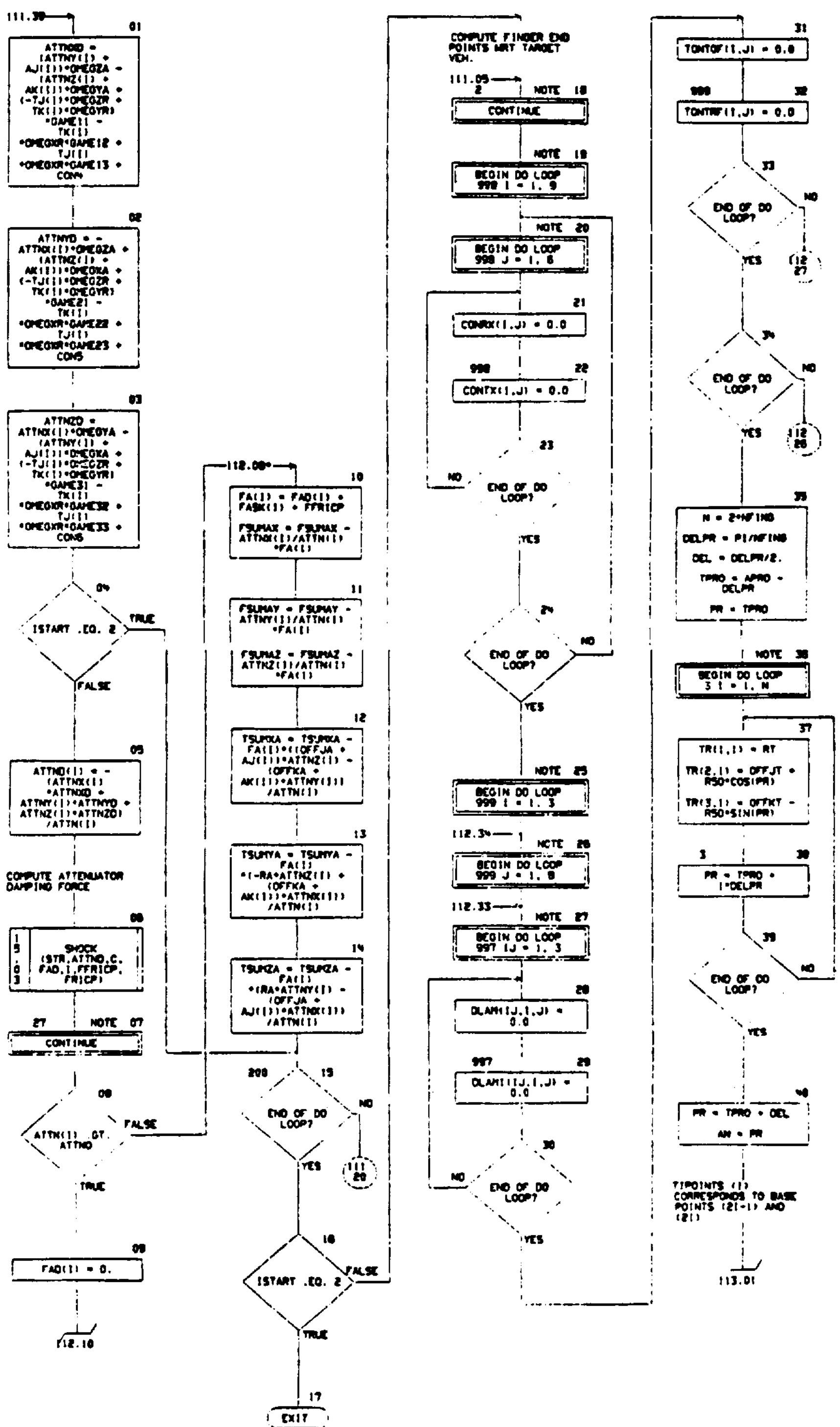

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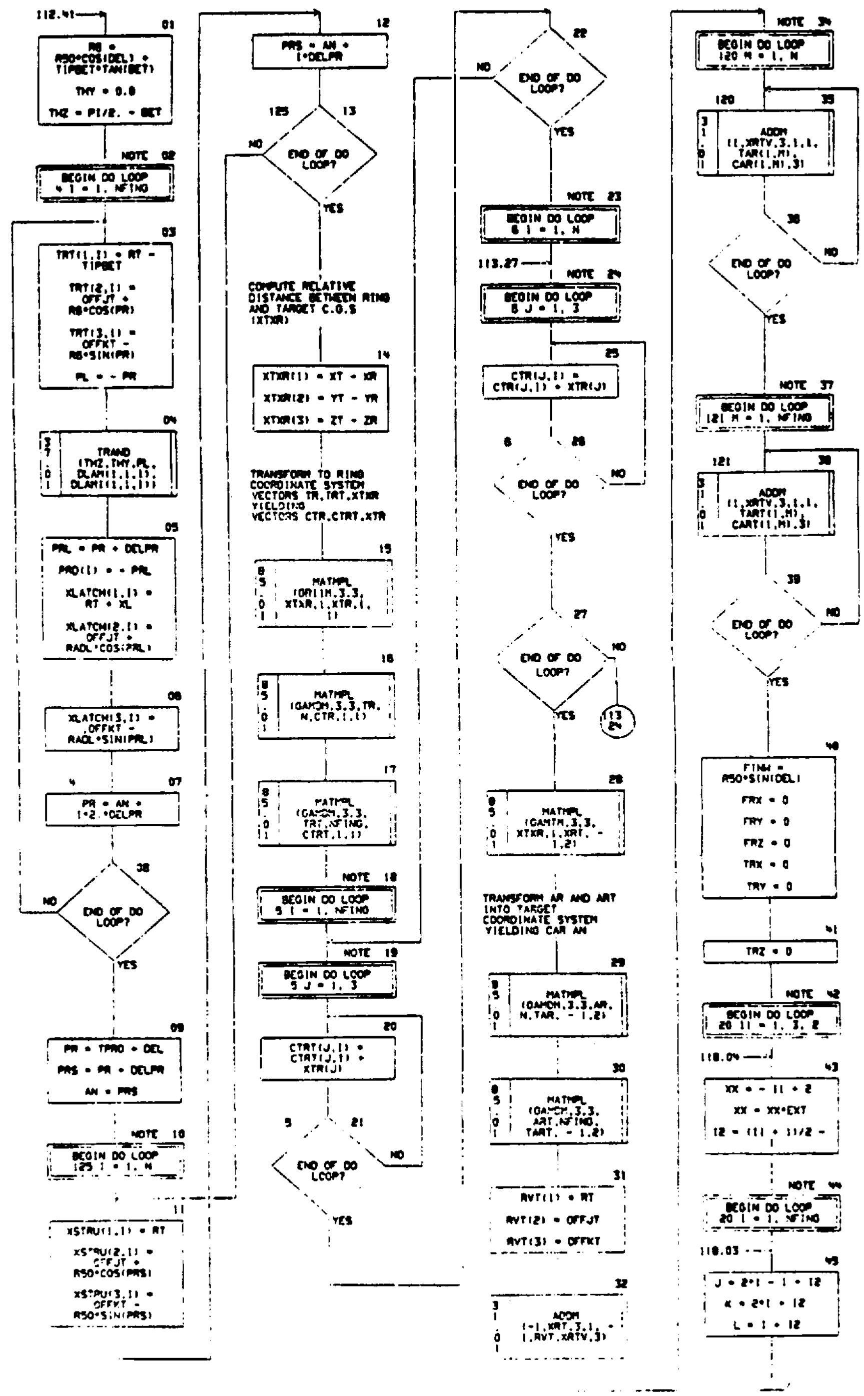

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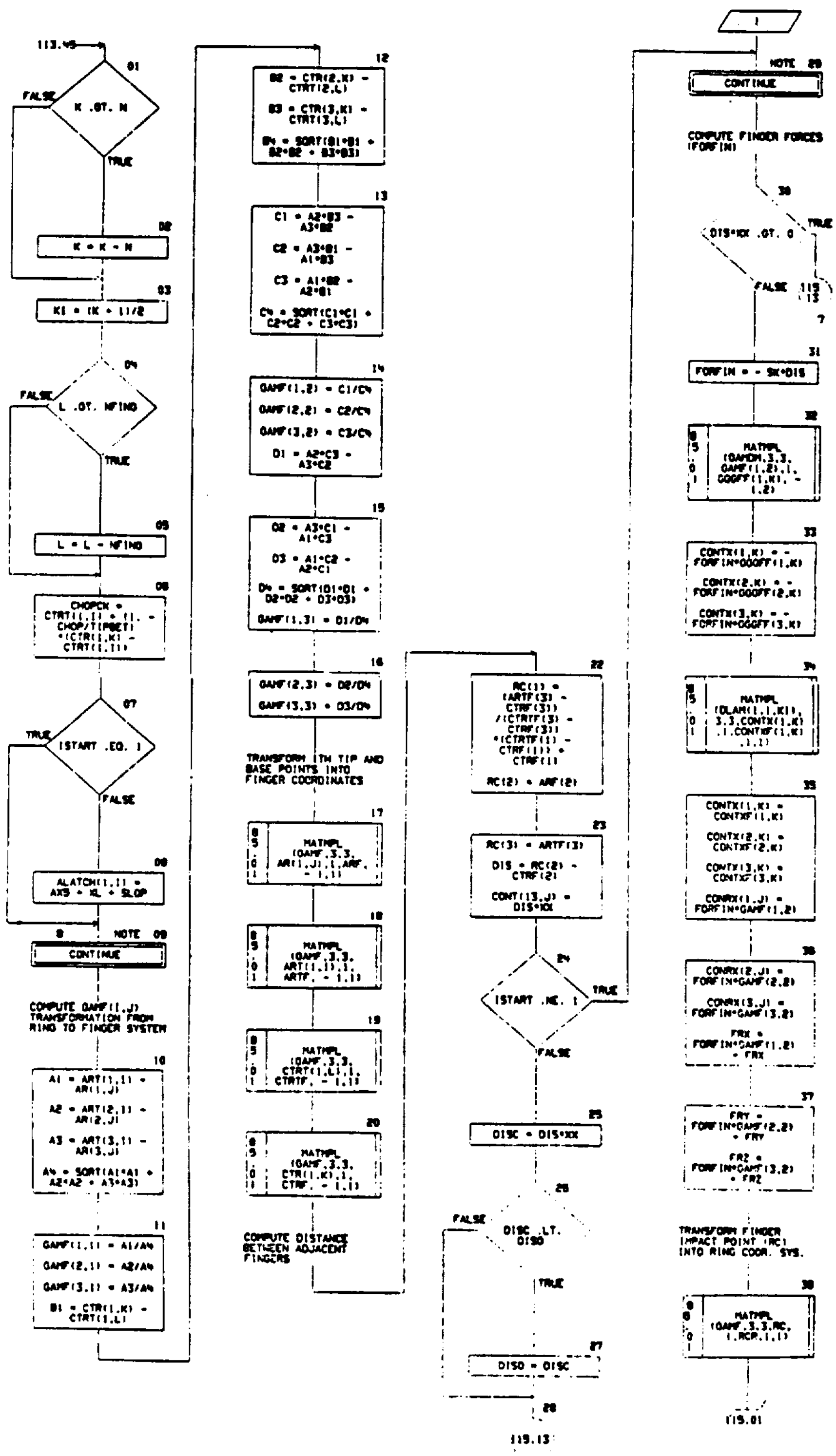
Rockwell International

CHART TITLE - SUBROUTINE FORCEI



Space Division
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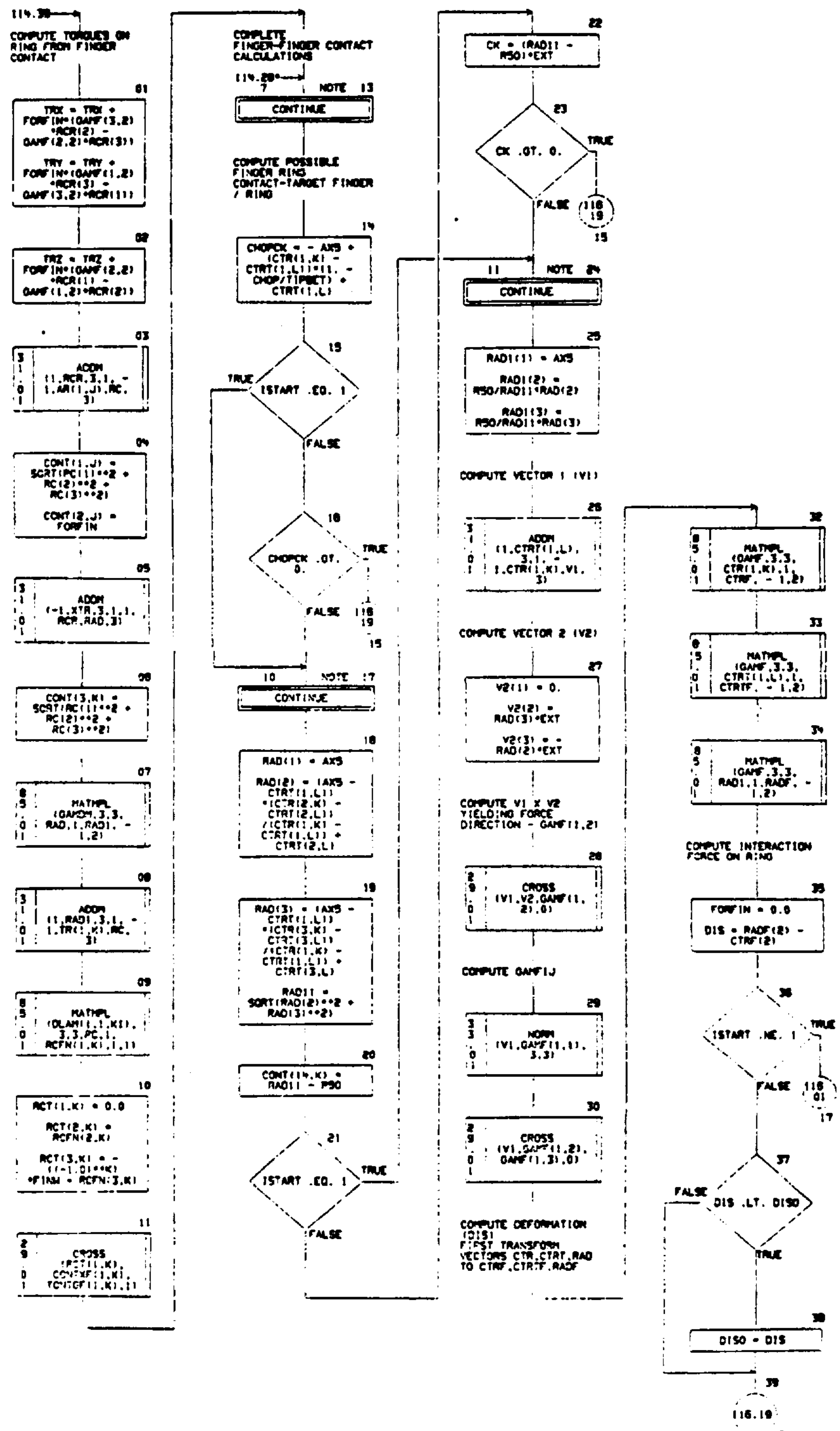
CHART TITLE - SUBROUTINE FORCE1



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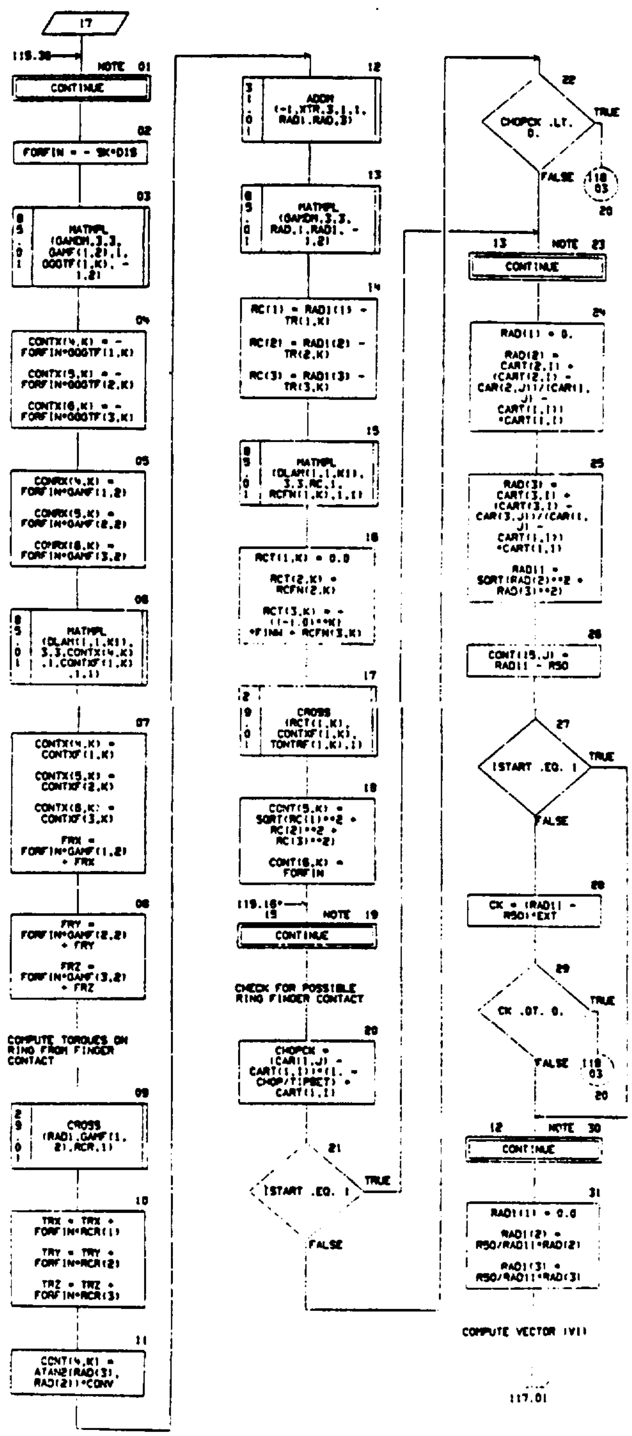

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CHART TITLE - SUBROUTINE FORCE1

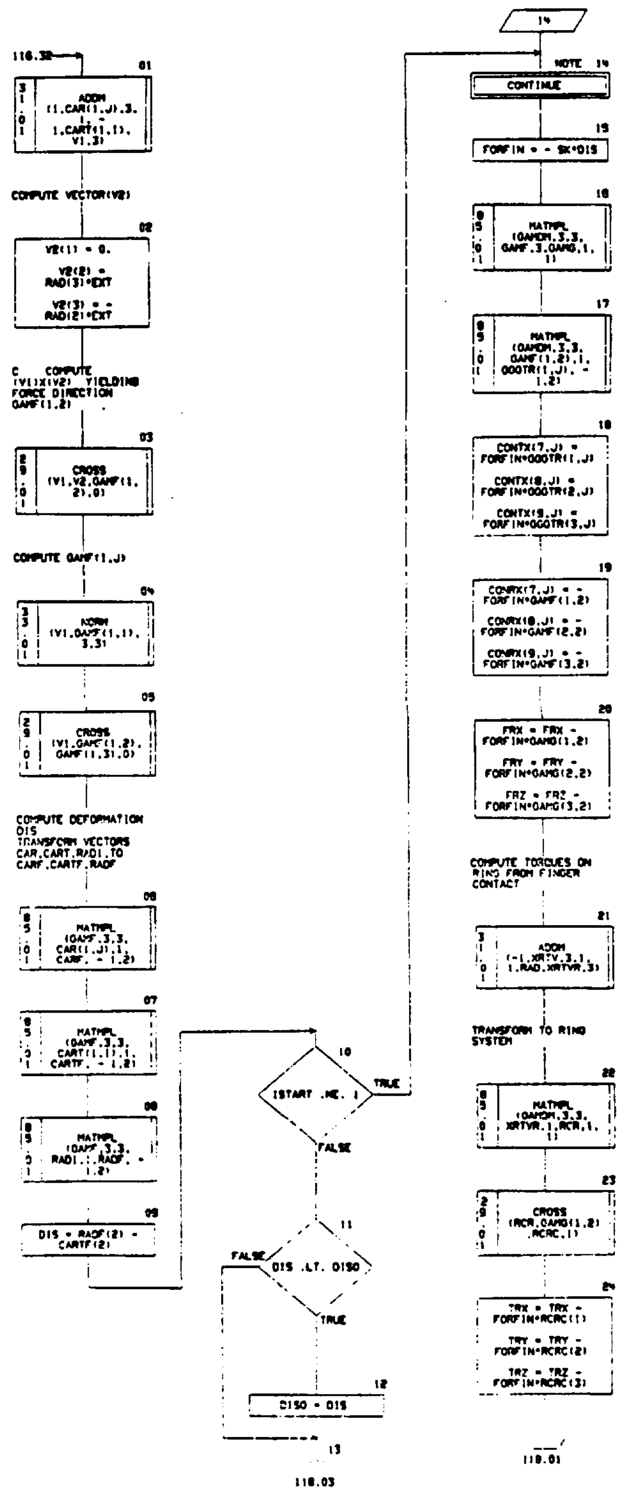

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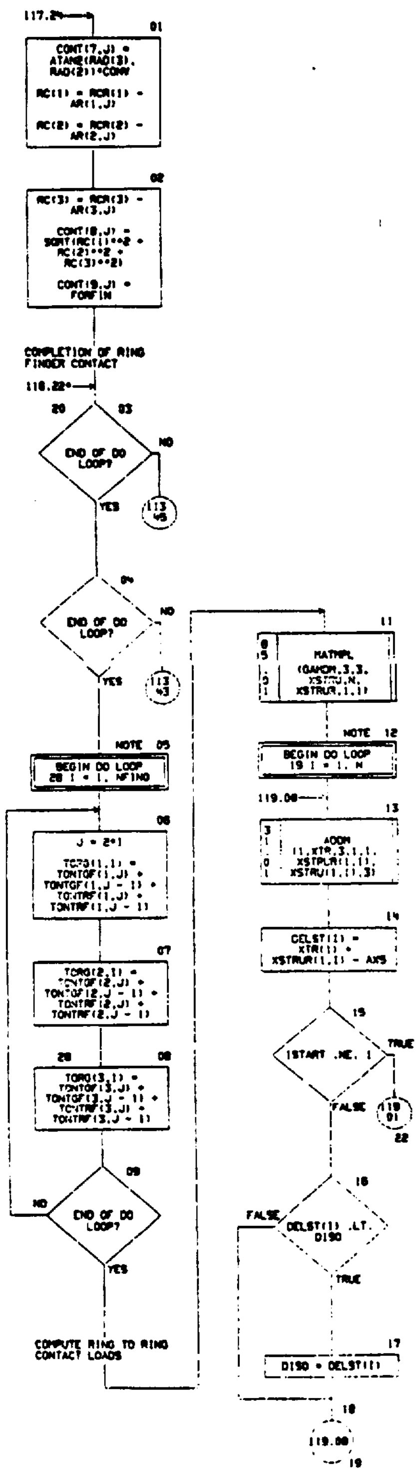
CHART TITLE - SUBROUTINE FORCE1



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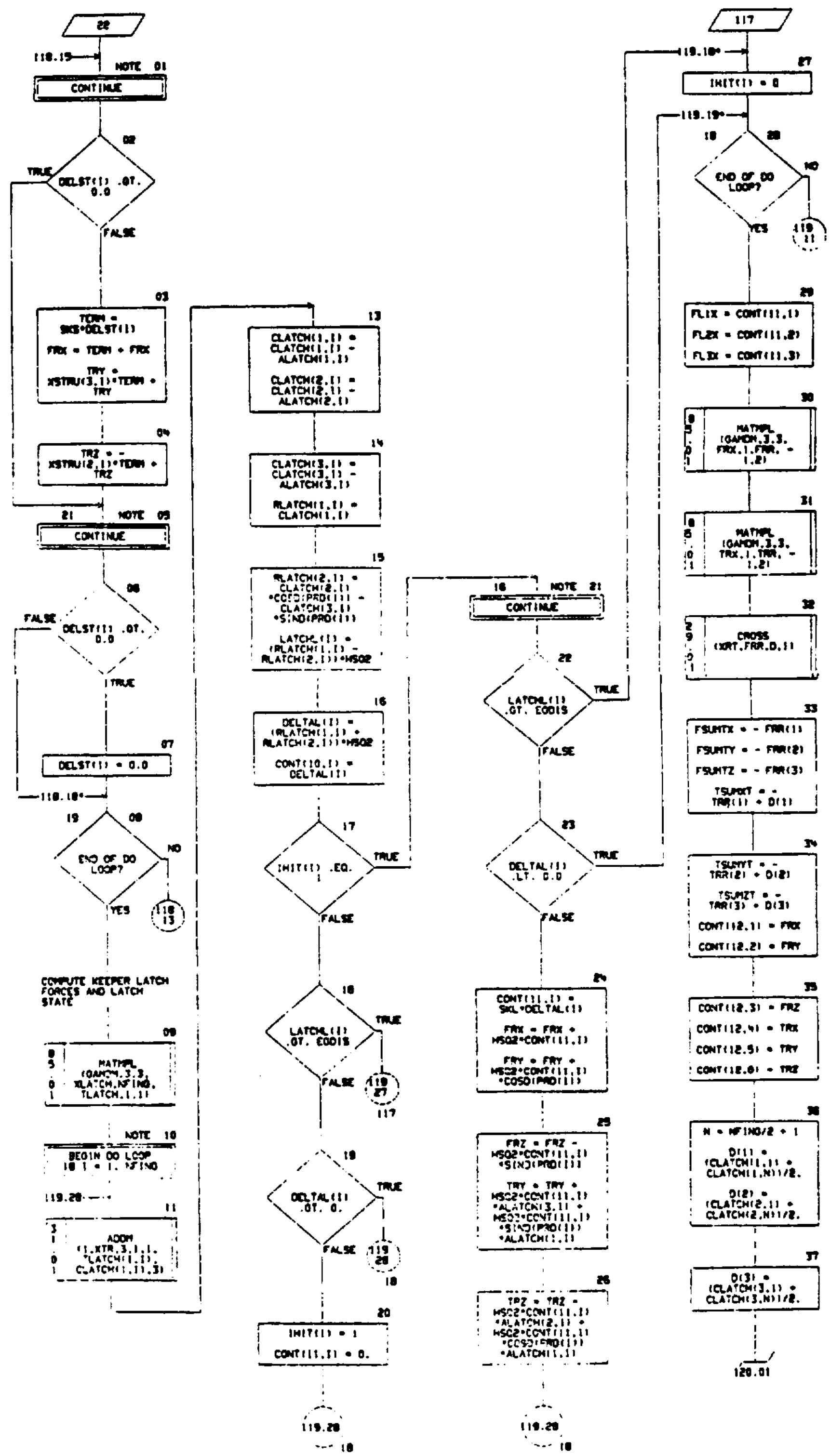
Space Division Rockwell International

CHART TITLE - SUBROUTINE FORCE1



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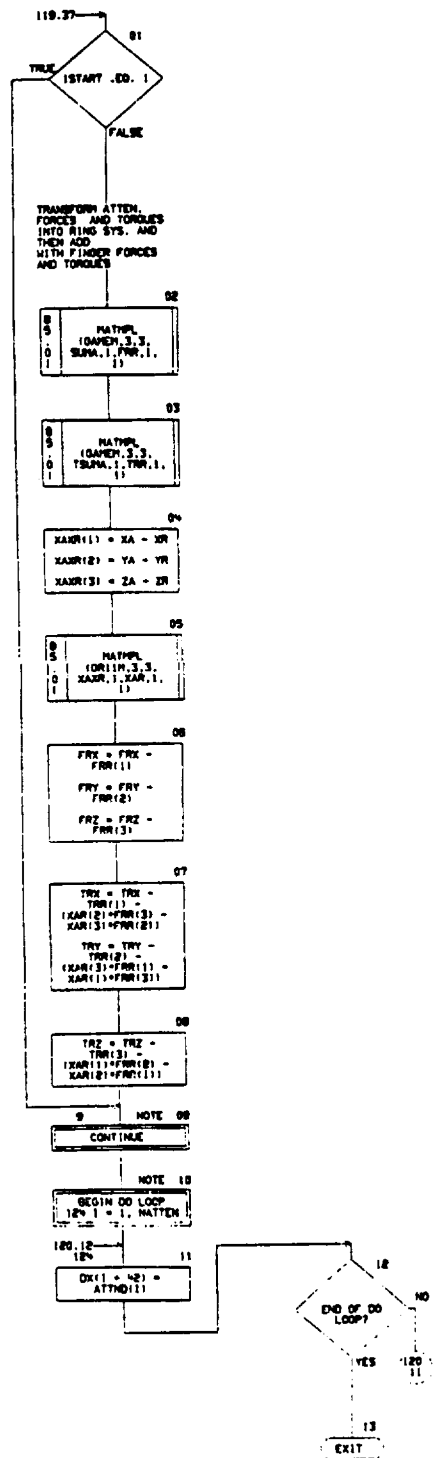
Rockwell International

CHART TITLE - SUBROUTINE FORCE1



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Space Division Rockwell International

CHART TITLE - NON-PROCEDURAL STATEMENTS

```
REAL*8 TYPE
DIMENSION TYPE(2)
DATA TYPE/'PRELATCH','W/LATCH '/
DIMENSION VAR(2400),T(2285),A(15),B(15),C(50),D(30),E(15),F(10),
          AA(25),AT(30),CO(10),SS(10)
DIMENSION ATTNX(20),ATTNY(20),ATTNZ(20),ATTN(20),STR(20),FASK(20)
,ATTNO(20),FAD(20),FA(20),AJ(20),AK(20),TJ(20),TK(20),THI(20)
 ,THR(20),V1(3),V2(3),RADF(3),XLATCH(3,20),TLATCH(3,20)
 ,CLATCH(3,20),INIT(20),RADI(3)
DIMENSION XRT(3),TAR(3,40),TART(3,20),XRTV(3),RVT(3),CAR(3,40),
 CART(3,20),RAD(3),CARF(3),CARTF(3),GANG(3,3),XRTVR(3),RCRC(3)
EQUIVALENCE(ADD(50),CKD),(ADD(51),SMIO),(ADD(52),AOC),(ADD(53),ACO
N),(ADD(94),R),(ADD(95),HCO)
,(ADD(71),XL),(ADD(72),RADL)
COMMON/LATCH/ALATCH(3,4),CLATCH
EQUIVALENCE(S(45),INIT(1)),(ADD(29),SKL)
DIMENSION  ADD(100),CO1(10),SS1(10)
EQUIVALENCE(ADD(70),JNI),(ADD(81),CO1(1)),(ADD(91),SS1(1))
DIMENSION ORIIN(3,3),GAMTH(3,3),GAMDM(3,3),GAMEN(3,3),CTR(3,40),
          TR(3,40),TRT(3,20),CTRT(3,20),ARF(3),ARTF(3),CTRF(3),
          CTRTF(3),SUMA(3),TSUMA(3),FRR(3),TRR(3),XAXR(3),XAR(3),
          XTR(3),XTXR(3),RCR(3),GAMF(3,3),RC(3)
EQUIVALENCE (ORIIN(1,1),ORI(1)),(GAMTH(1,1),GAMT(1)),(GAMDM(1,1),
 GAMD(1)),(GAMEN(1,1),GAME(1))
EQUIVALENCE(ADD(1),RR),(ADD(2),OFFJR),(ADD(3),OFFKR)
          ,(ADD(4),XMR),(ADD(5),XXIR),(ADD(6),YYIR),(ADD(7),ZZIR)
          ,(ADD(8),NFINO),(ADD(9),APRO),(ADD(13),AZ5),(ADD(14),BET
         1,(ADD(15),TIPBET),(ADD(16),TPRO),(ADD(17),CHOP)
          ,(ACD(18),SK),(SUMA(1),FSUMAX),(TSUMA(1),TSUMXA)
          ,(ACD(10),R5O),(ACD(11),AX5),(ADD(12),AY5)
          ,(ACD(19),DISO),(ADD(20),ISTART)
EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
           (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
           (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
           (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
           (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
           (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
           (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
           (T(29),YTD),(T(30),ZTD)
EQUIVALENCE(T(31),XRD),(T(32),YRD),(T(33),ZRD),(T(34),XR),(T(35),
     YR),(T(36),ZR),(T(37),THR),(T(38),PSR),(T(39),PHR),(T(40),
   OMEGXR),(T(41),OMEGYR),(T(42),OMEGZR)
           ,(DX(19),XPD),(DX(20),YPD),(DX(21),ZPD),(DX(24),ZDD)
EQUIVALENCE (A(9),OFFJA),
           (A(10),OFFKA),(A(11),RA)
EQUIVALENCE(C(25),GAMA),(C(18),RATIO)
EQUIVALENCE (B(9),OFFJT),
           (B(10),OFFKT),(B(11),RT)
EQUIVALENCE (C(1),NATTEN),(C(2),DA),(C(3),DT),(C(4),ALPHA)
,(C(8),THMA),(C(9),PRELDI),(C(10),DELPRE),(C(11),BRATE)
,(C(12),A10),(C(13),B10),(C(14),C10),(C(15),EXRATE),(C(16),FCONP)
,(C(17),BOTTOM)
.          (C(19),F1),(C(21),EM),(C(22),V0),(C(23),BYZ),(C(24),AO)
,(F(2),THESH)
 , (C(5),EXT),(SLOP,C(6))
COMMON/STRV/TRT
REAL*4 LATCHL
COMMON /FOLLY/LATCHL(3) ,PRO(3)
EQUIVALENCE (E(5),ITABLE),(E(9),JN)
EQUIVALENCE(STOP,E(3))
DIMENSION CONT(15,20)
EQUIVALENCE(ADD5(1),CONT(1,1))
EQUIVALENCE(S(35),MODE),(S(36),K),(S(37),VEL)
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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EQUIVALENCE (VAR(1),A(1)),(VAR(10),B(1)),(VAR(31),C(1)),
            (VAR(81),D(1)),(VAR(111),E(1)),(VAR(128),F(1)),
            (VAR(138),AA(1)),(VAR(181),AT(1)),(VAR(191),CO(1)),
            (VAR(201),SS(1)),(VAR(211),T(1))
COMMON/EFLEX/TIME,OX(158),ADDS(1000)
COMMON VAR
COMMON/DVIEW/CON1,CON2,CON3,CTR,CTRT
COMMON/OUTH/XAXR,RVT,KTXR
COMMON/ATTACH/AJ,AK,TJ,TK,FA,ATTND,STR,ATTN,TH1,TH2,ATTNO
,ATTNX,ATTNY,ATTNZ
COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
 GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
 GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
 GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
 GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
 GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
 GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
 GAMP32,GAMP33
,GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
,PROBEA,TLSA,I1,IKA1,THESH1,CONST
COMMON/CALCU/F0,FC,F1,TOR1,FS1,FS2,FS3,FCR1,FCR2,FCR3,ETA1,
 ETA2,ETA3,FRT1A,FRT2A,FRT3A,TLS1,TLS2,TLS3,FRT1B,FRT2B,FRT3B,
 VELB1,VELB2,VELB3,VELP,FRICP,FRC1,FRC2,FRC3,PRODEL
COMMON/FORC/FSUMAX,FSUMAY,FSUMAZ,TSUMXA,TSUMYA,TSUMZA,TSUMXT,
 TSUMYT,TSUMZT,FSUMTX,FSUMTY,FSUMTZ
COMMON/ADONEW/ADD
COMMON /ADDLF/ ALF(50)
DIMENSION ABB(10),ORD(10),SS2(10),COR(10)
EQUIVALENCE (ALF(01),ABB(1)),(ALF(11),ORD(1)),
            (ALF(21),SS2(1)),(ALF(31),COR(1)),
            (ALF(41),ITSPO1, (ALF(42),JNE)
COMMON/FORCR/FRX,FRY,FRZ,TRX,TRY,TRZ
COMMON/TRANR/OR11,OR21,OR31,OR12,OR22,OR32,OR13,OR23,OR33
COMMON/RECAL/S(2885)
COMMON/FIN/AR(3,40),ART(3,20)
COMMON /FRCE/ CONTX(9,8),CONRX(9,8),IFRCE
               ,DELST(10)
DIMENSION         RLATCH(2,3),DELTAL(3)
DIMENSION XSTRU(3,10),XSTRUR(3,10)
EQUIVALENCE (SKS,C(9))
DIMENSION OOOFF(3,8),OOGTF(3,8),OOGTR(3,8)
DIMENSION DLAM(3,3,8),DLAM1(3,3,8),CONTXF(3,8),RCFN(3,8),
          RCT(3,8),TONTOF(3,8),TONTRF(3,8)
COMMON /MMX/ TORO(3,8)
DATA PI/Z413243F7/
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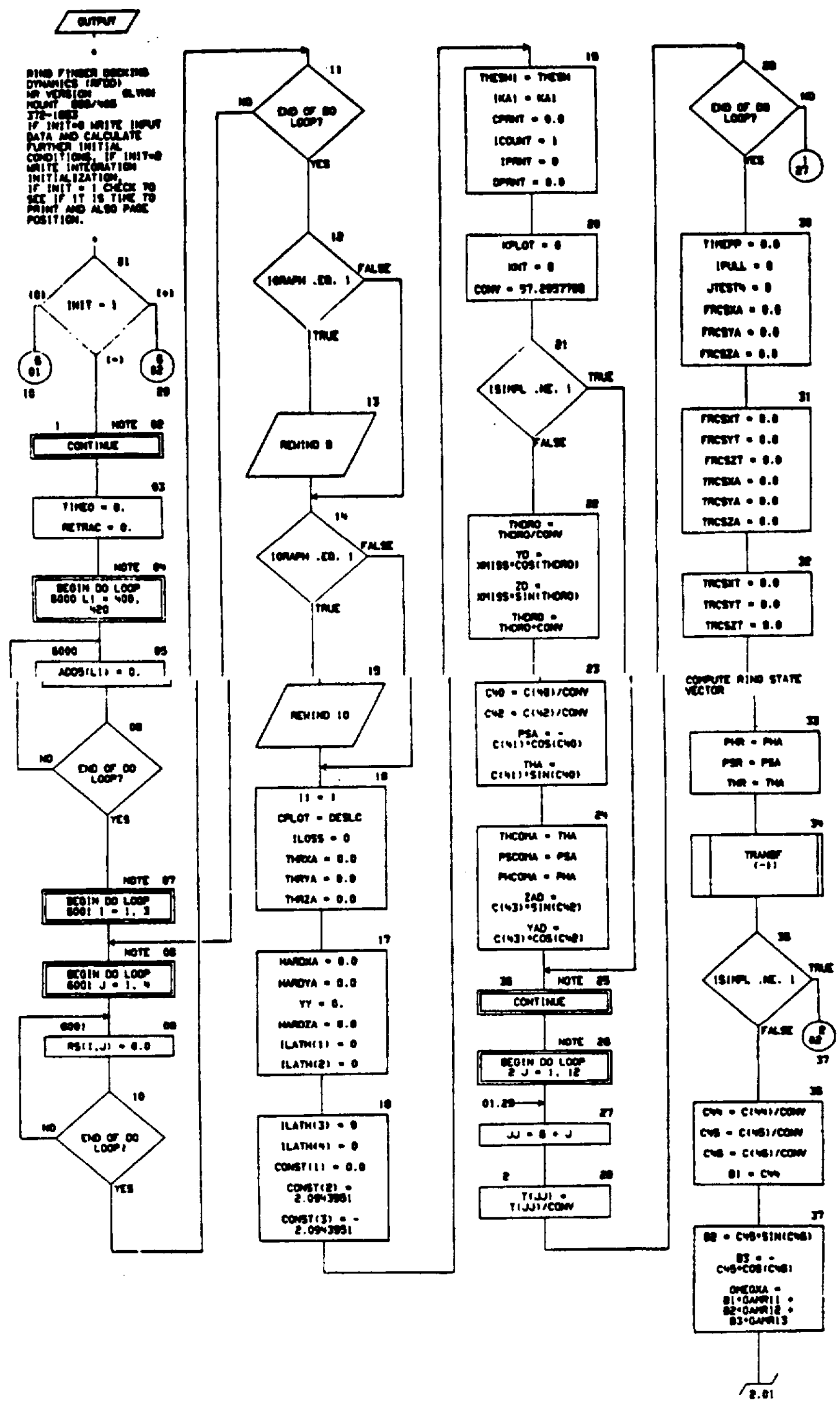
CHART TITLE - SUBROUTINE OUTPUT(INIT)



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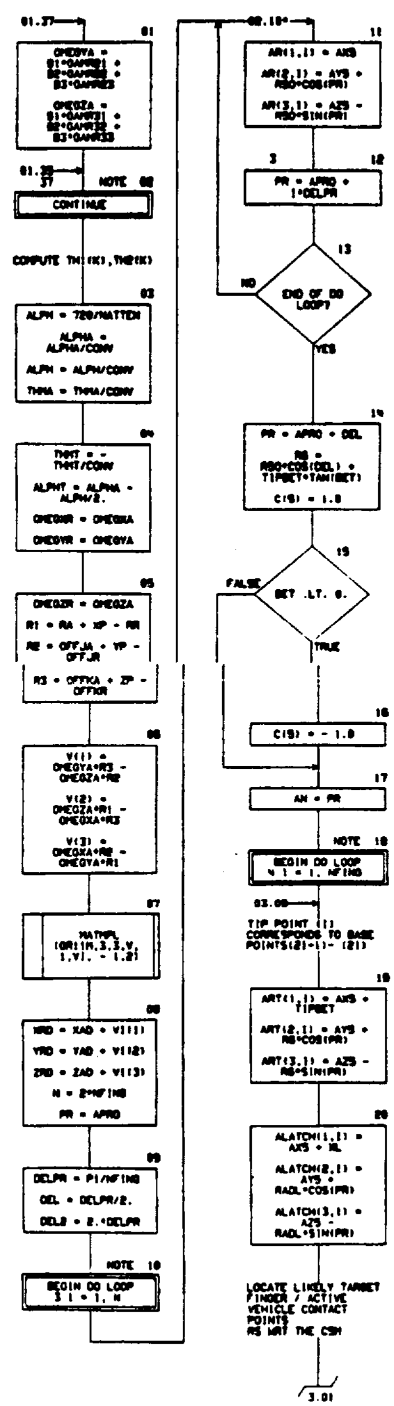

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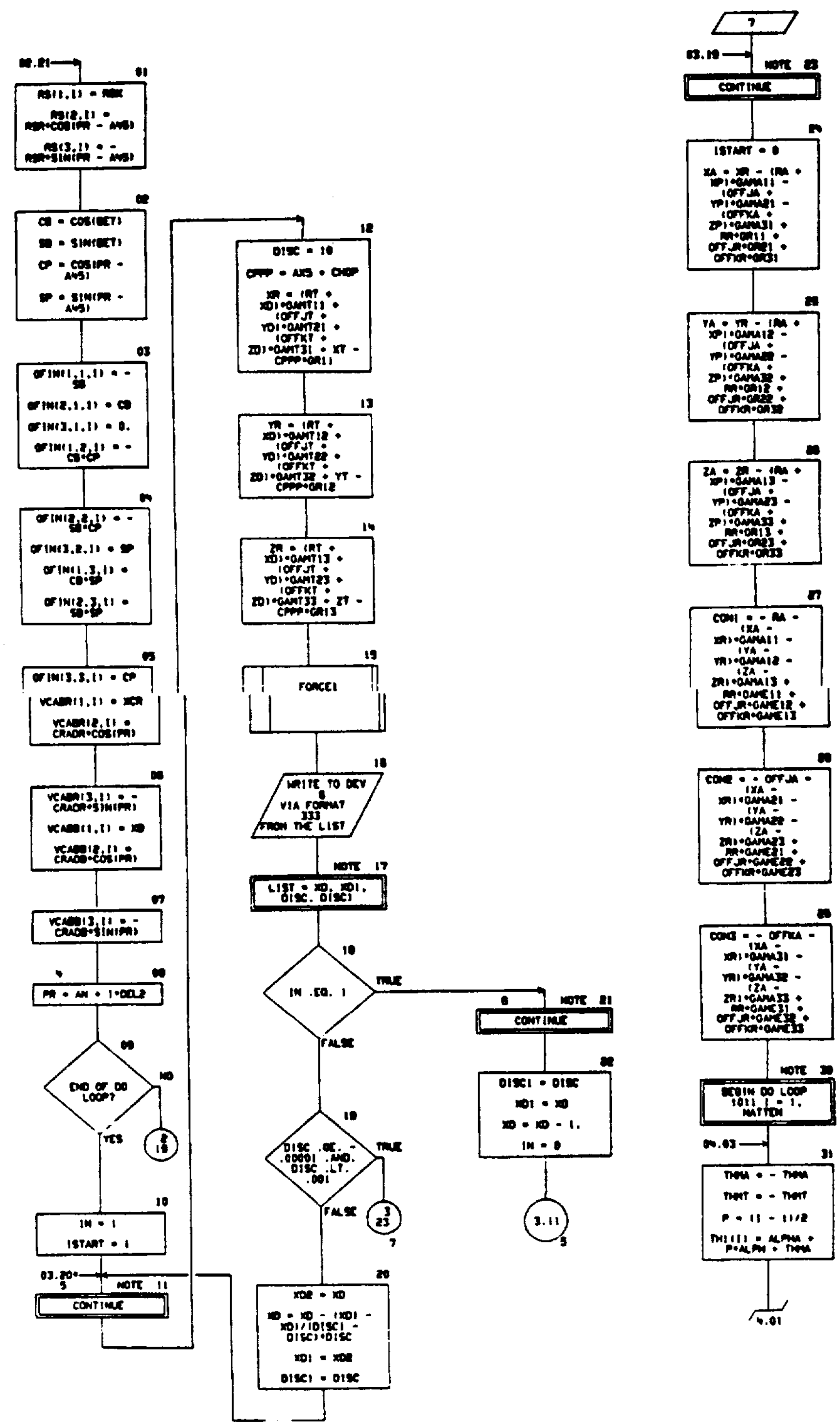
CHART TITLE - SUBROUTINE OUTPUT(INIT)



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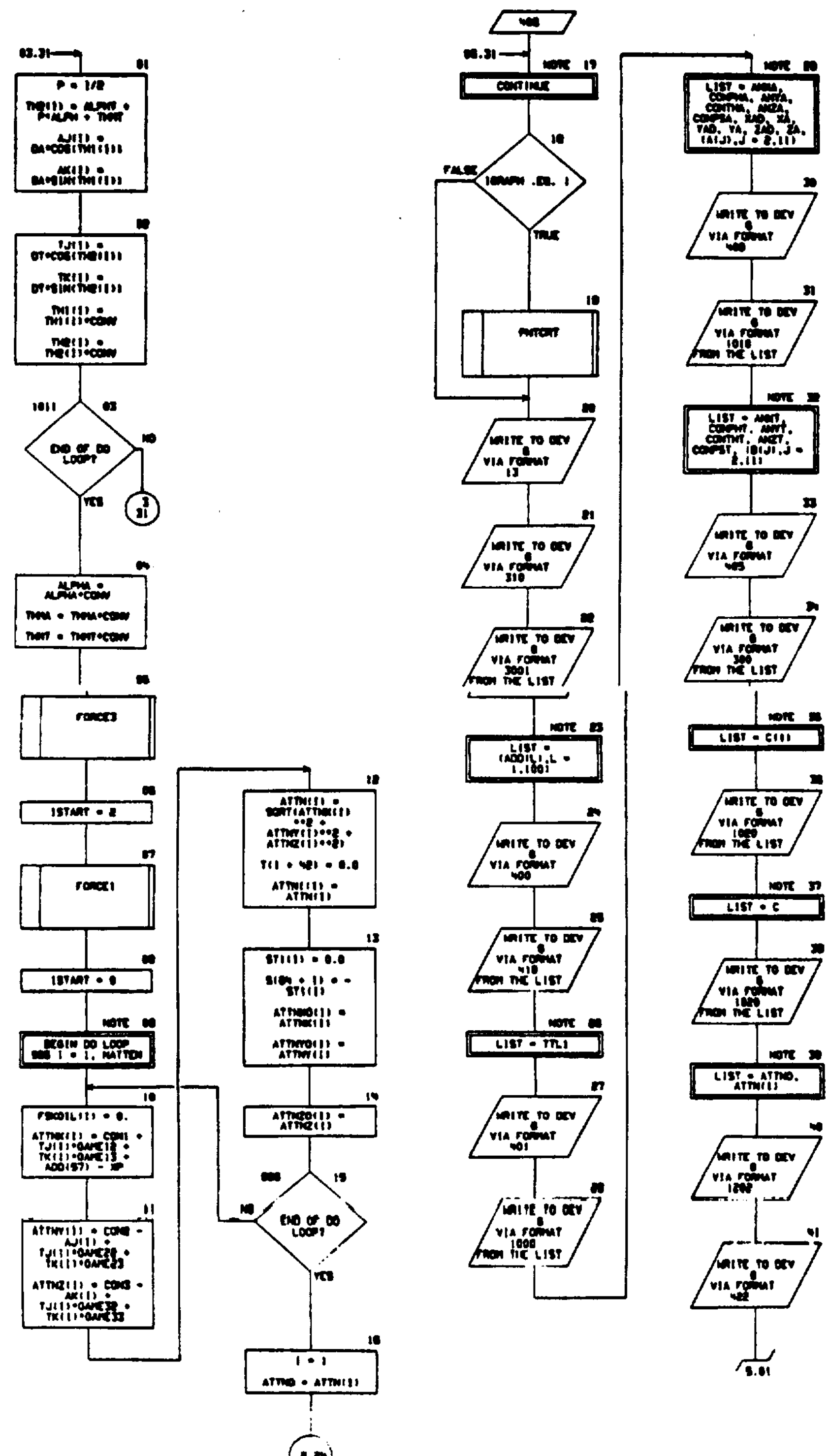

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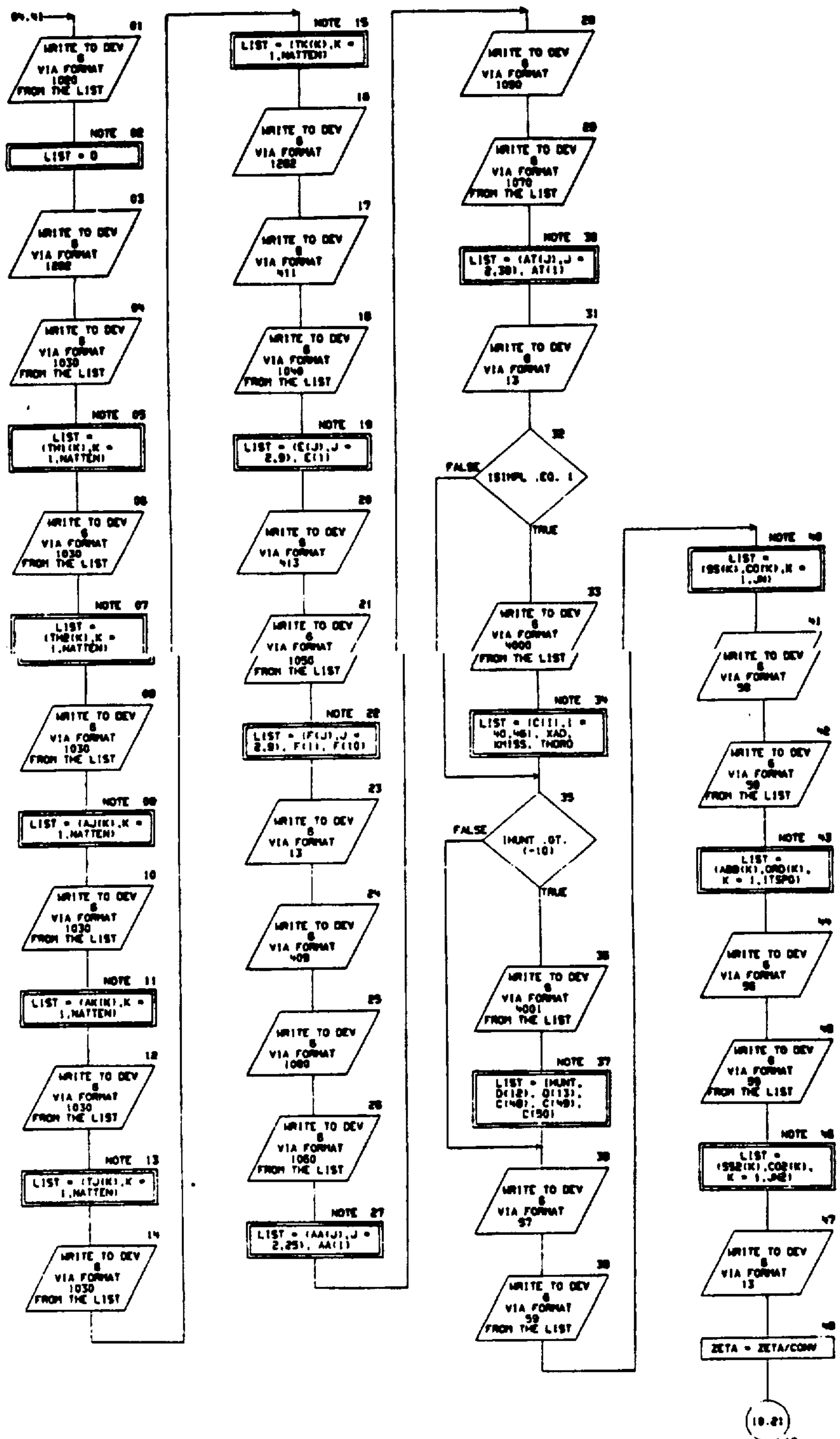
CHART TITLE - SUBROUTINE OUTPUT(INIT)



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Space Division
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CHART TITLE - SUBROUTINE OUTPUT(INIT)

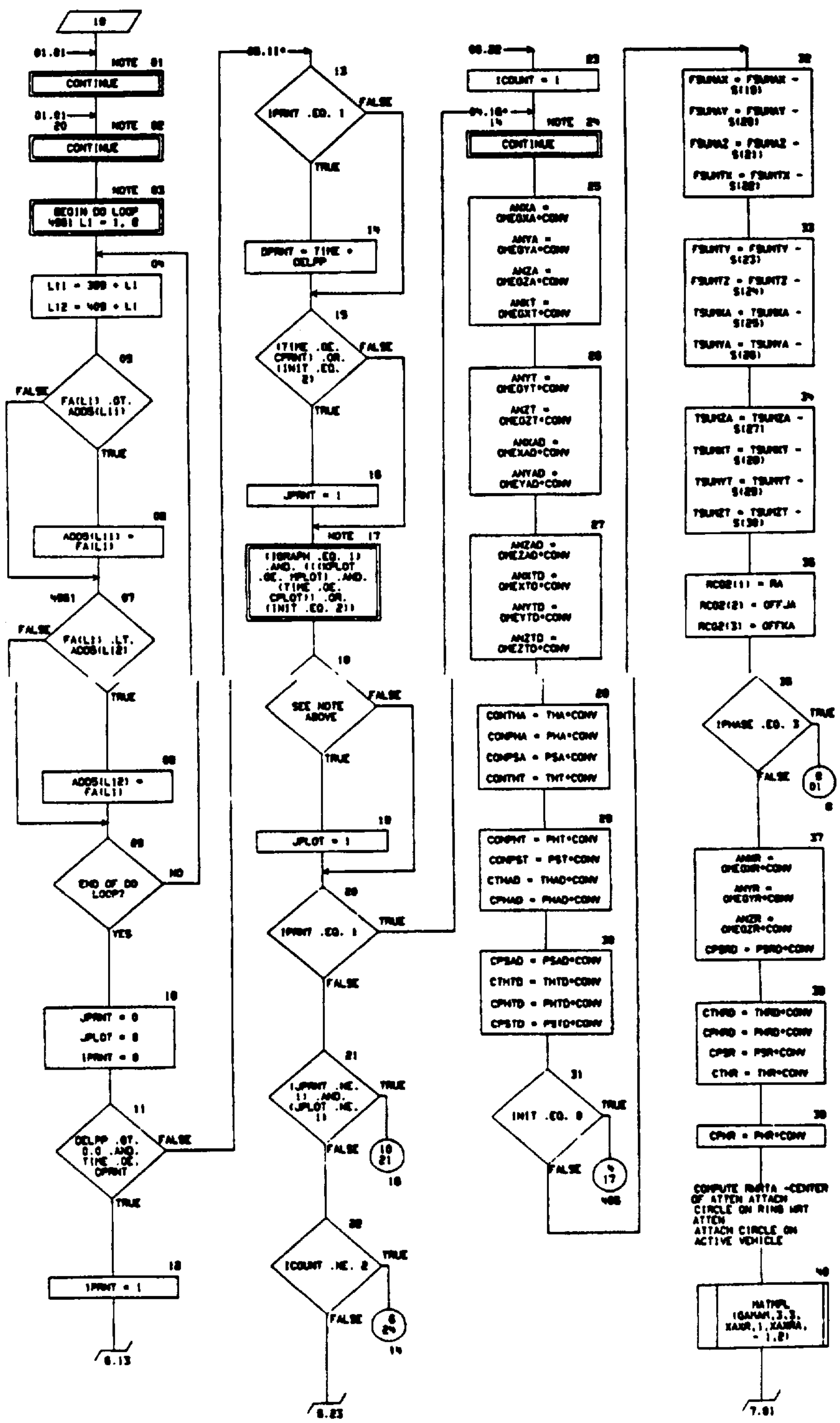

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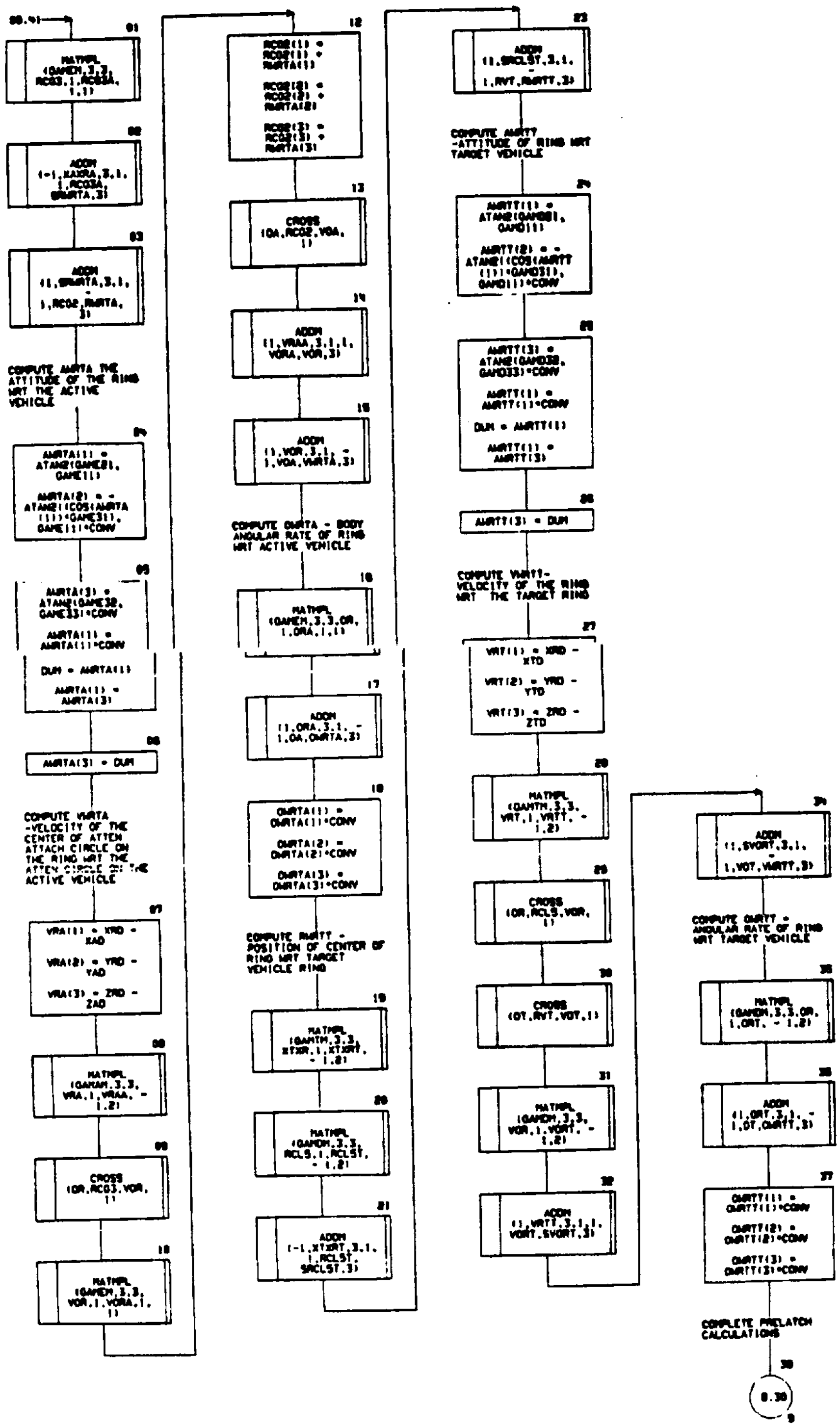
CHART TITLE - SUBROUTINE OUTPUT(INIT)



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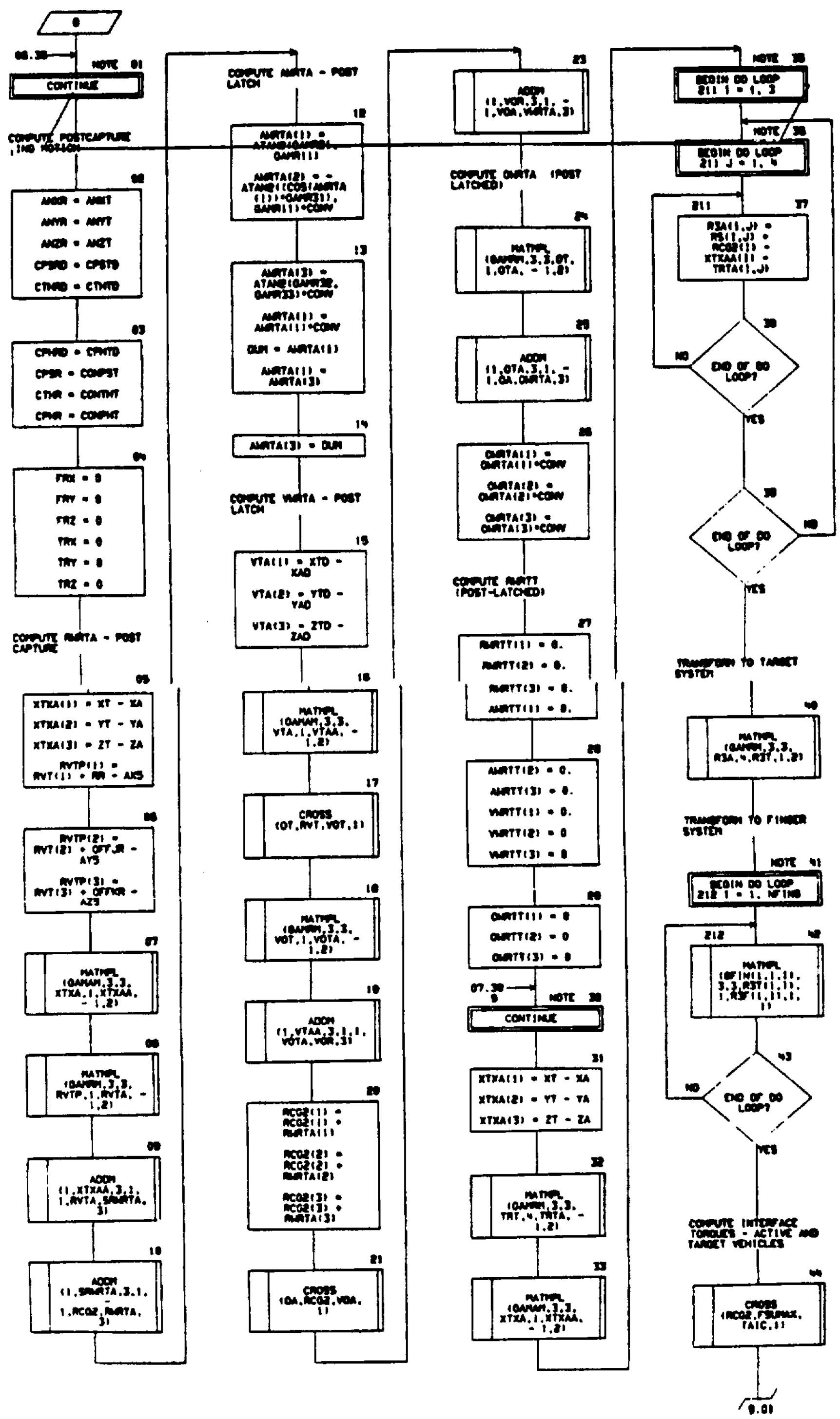

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Rockwell International

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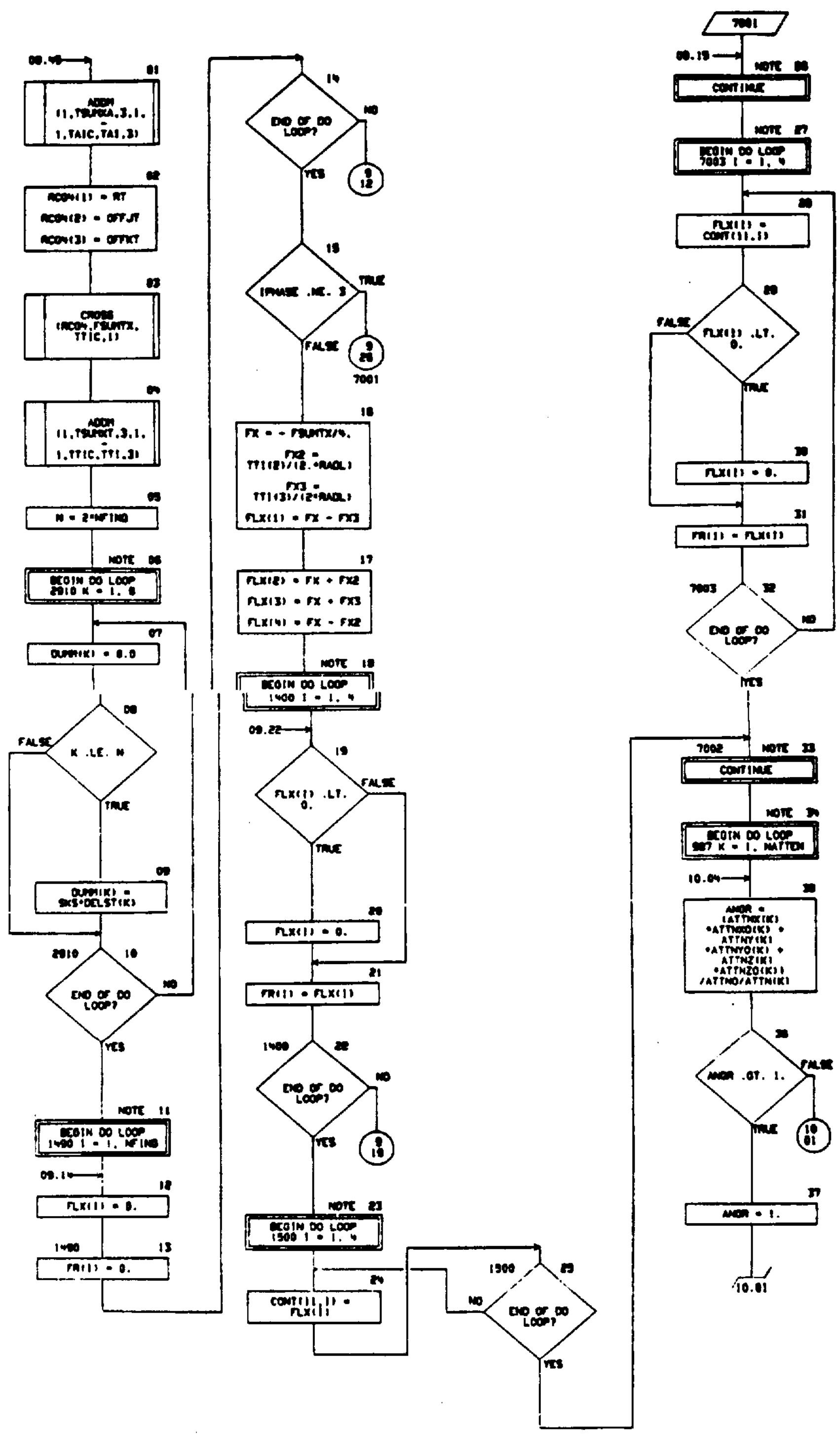

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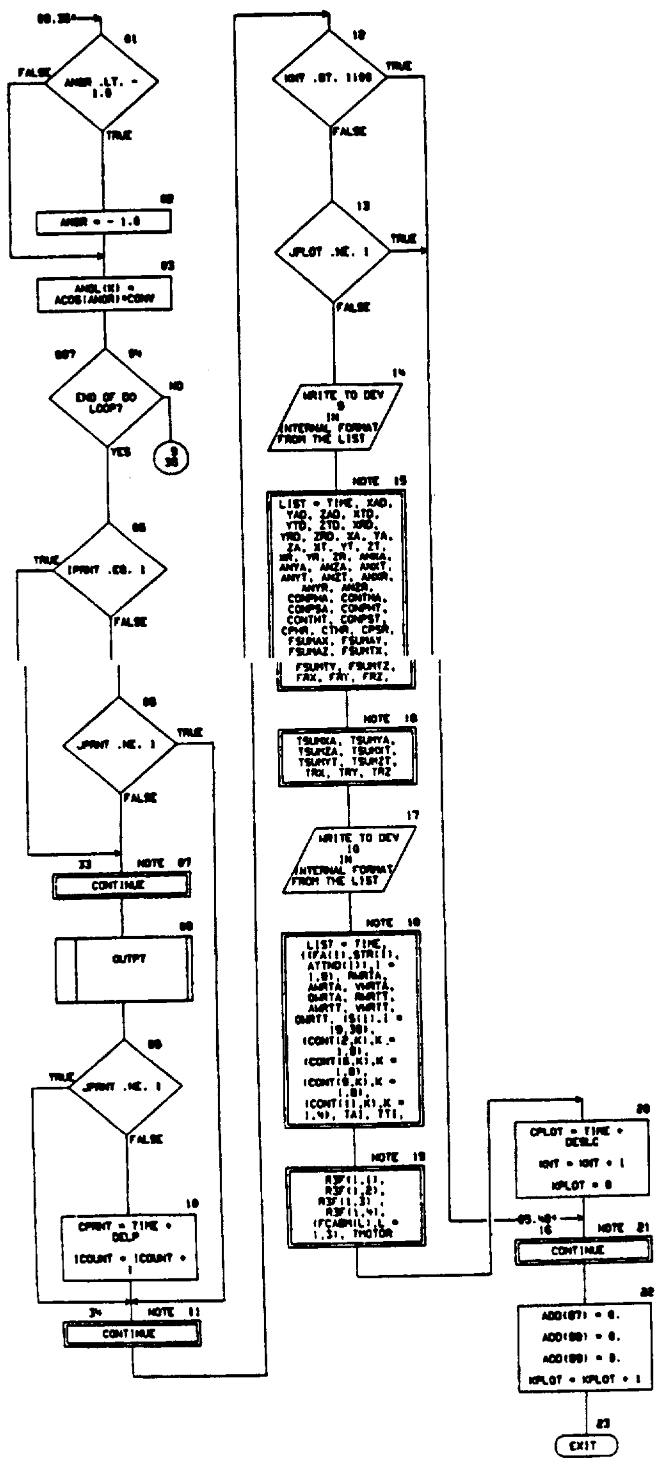

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CHART TITLE - NON-PROCEDURAL STATEMENTS

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 ,S(2000)
,ADD(100)
DIMENSION ATTHX(20),ATTHY(20),ATTHZ(20),ATTH(20),STR(20),FABK(20)
,ATTHD(20),FAD(20),FA(20),AJ(20),AK(20),TJ(20),TK(20),TH1(20)
 ,TH2(20)
DIMENSION VAR(2400),T(2000),A(15),B(15),C(50),D(30),E(15),F(10),
         AA(25),AT(30),CO(10),SS(10)
DIMENSION ATTHXO(8),ATTHYO(8),ATTHZO(8),ANGL(8)
COMMON/FIN/AR(3,40),ART(3,20)
COMMON/LATCH/ALATCH(3,4),CLATCH(3,20)
EQUIVALENCE(ADD(71),XL),(ADD(72),RADL)
DIMENSION ORIIN(3,3),V(3),VI(3)
          ,INIT(20)
EQUIVALENCE(ORIIN(1,1),ORI)
DIMENSION CONT(15,20)
EQUIVALENCE(ADDS(1),CONT(1,1))
EQUIVALENCE(ADD(1),RR),(ADD(2),OFFJR),(ADD(3),OFFKR)
         ,(ADD(4),XMR),(ADD(5),XXIR),(ADD(6),YYIR),(ADD(7),ZZIR)
         ,(ADD(8),NFING),(ADD(9),APRO),(ADD(13),AZS),(ADD(14),BET
        ),(ADD(15),T(PSET),(ADD(16),TPRO),(ADD(17),CHOP)
          ,(ADD(18),SK)
          ,(ADD(10),RSO),(ADD(11),AXS),(ADD(12),AYS)
          ,(ADD(19),DISC),(ADD(20),ISTART)
EQUIVALENCE (T(1),XA),(T(2),YA),(T(3),ZA),(T(4),XT),(T(5),YT),
          (T(6),ZT),(T(7),OMEGXA),(T(8),OMEGYA),(T(9),OMEGZA),
          (T(10),OMEGXT),(T(11),OMEGYT),(T(12),OMEGZT),
          (T(13),THA),(T(14),PHA),(T(15),PSA),(T(16),THT),
          (T(17),PHT),(T(18),PST),(T(19),XP),(T(20),YP),
          (T(21),ZP),(T(22),XD),(T(23),YD),(T(24),ZD),
          (T(25),XAD),(T(26),YAD),(T(27),ZAD),(T(28),XTD),
           (T(29),YTD),(T(30),ZTD)
 EQUIVALENCE(T(31),XRD),(T(32),YRD),(T(33),ZRD),(T(34),XR),(T(35),
      YR),(T(36),ZR),(T(37),THR),(T(38),PSR),(T(39),PHR),(T(40),
    OMEGXR),(T(41),OMEGYR),(T(42),OMEGZR)
          ,(S(45),INIT(1))
 EQUIVALENCE (DX(1),DXAD),(DX(2),DYAD),(DX(3),DZAD),(DX(4),DXTD),
           (DX(5),DYTD),(DX(6),DZTD),(DX(7),OMEXAD),(DX(8),OMEYAD
           ),(DX(9),OMEZAD),(DX(10),OMEXTD),(DX(11),OMEYTD),
           (DX(12),OMEZTD),(DX(13),THAD),(DX(14),PHAD),
           (DX(15),PSAD),(DX(16),THTD),(DX(17),PHTD),(DX(18),PSTD
          ),(DX(19),XPD),(DX(20),YPD),(DX(21),ZPD)
          ,(DX(24),ZDD),(DX(25),XADD),(DX(26),YADD),
          (DX(27),ZADD),(DX(28),XTDD),(DX(29),YTDD),(DX(30),ZTDD)
 EQUIVALENCE(DX(31),XRDD),(DX(32),YRDD),(DX(33),ZRDD),(DX(34),DXRD)
          ,(DX(35),DYRD),(DX(36),DZRD),(DX(37),THRD),(DX(38),PSRD)
          ,(DX(39),PHRD),(DX(40),OMEXRD),(DX(41),OMEYRD)
          ,(DX(42),OMEZRD)
 EQUIVALENCE (A(2),XMA),(A(3),XXIA),(A(4),YYIA),(A(5),ZZIA),
           (A(6),XYIA),(A(7),XZIA), (A(8),YZIA),(A(9),OFFJA),
           (A(10),OFFKA),(A(11),RA)
 EQUIVALENCE (B(2),XMT),(B(3),XXIT),(B(4),YYIT),(B(5),ZZIT),
           (B(6),XYIT),(B(7),XZIT),(B(8),YZIT),(B(9),OFFJT),
           (B(10),OFFKT),(B(11),RT)
 EQUIVALENCE (C(1),NATTEN),(C(2),DA),(C(3),DT),(C(4),ALPHA)
 ,(C(6),THMT),(C(9),PRELD1),(C(10),DELPRE),(C(11),BRATE)
 ,(C(47),ISIMPL),(D(14),IHUNT)
 ,          (C(7),THMA),(C(19),THORO),(C(20),XM1SS)
  , (C(5),EXT),(SLOP,C(8))
 EQUIVALENCE(NPLOT,E(1))
 , (S(19),FRCSXA),(S(20),FRCSYA),(S(21),FRCSZA),(S(22),FRCSXT),
  (S(23),FRCSYT),(S(24),FRCSZT),(S(25),TRCSXA),(S(26),TRCSYA),
  (S(27),TRCSZA),(S(28),TRCSXT),(S(29),TRCSYT),(S(30),TRCSZT)
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CHART TITLE - NON-PROCEDURAL STATEMENTS

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      DIMENSION STI(10),FSNOIL(10),ATTNI(10)
      EQUIVALENCE(S(80),STI(1)),(S(75),FSNOIL(1))
      EQUIVALENCE (E(2),IPHASE),(E(3),STOP),(E(4),DELPP),(E(5),CASE),
                  (E(6),IGRAPH),(E(7),DELP),(E(8),DESLC),(E(9),JN),
                  (E(10),ICASE)
      EQUIVALENCE (F(2),THESH),(F(4),A3),(F(5),AB),(F(6),KA1),
                  (F(7),A8),(F(8),A4),(F(9),A7)
      EQUIVALENCE (AA(2),THCONA),(AA(3),PHCONA),(AA(4),PSCONA),
                  (AA(5),ARXA),(AA(6),ARYA),(AA(7),ARZA),(AA(8),ADPHA),
                  (AA(9),ADTHA),(AA(10),ADPSA),(AA(11),TXA),(AA(12),TYA)
                 ,(AA(13),TZA),(AA(14),DBANXA),(AA(15),DBANYA),
                  (AA(16),DBANZA),(AA(17),FXA),(AA(18),REACTA),
                  (AA(19), BANXA),(AA(20),BANYA),(AA(21),BANZA)
      EQUIVALENCE (AT(2),DRNOR),(AT(3),DYRX),(AT(4),TRCST),(AT(5),DPX),
                  (AT(6),ARXT),(AT(7),ARYT),(AT(8),ARZT),(AT(9),ADPHT),
                  (AT(10),ADTHT),(AT(11),ADPST),(AT(12),DBANXT),
                  (AT(13),DBANYT),(AT(14),DBANZT),(AT(15),THCONT),
                  (AT(16),PHCONT),(AT(17),PSCONT),(AT(18),REACTT),
                  (AT(19),BANXT),(AT(20),BANYT),(AT(21),BANZT),
                  (AT(22),TXT),(AT(23),TYT),(AT(24),TZT),(AT(25),FXT),
                  (AT(26),RMAXT),(AT(27),YMAXT),(AT(28),PMAXT),
                  (AT(29),IRCS),(AT(30),IVEH)
      EQUIVALENCE (VAR(1),A(1)),(VAR(6),B(1)),(VAR(3),C(1)),
                  (VAR(8),D(1)),(VAR(11),E(1)),(VAR(126),F(1)),
                  (VAR(136),AA(1)),(VAR(161),AT(1)),(VAR(191),CO(1)),
                  (VAR(201),SS(1)),(VAR(211),T(1))
      DIMENSION XAXR(3),RCG3(3),XAXRA(3),RCG3A(3),XTXA(3),RVTP(3),
               GAMAN(3,3),GAMEN(3,3),XTXAA(3),RVT(3),RVTA(3),SRWRTA(3)
              ,RCG2(3),RWRTA(3),VRA(3),VRAA(3),OR(3),VOR(3),VORA(3),
               VWRTA(3),VTA(3),ORA(3),OTA(3),VTAA(3),VOTA(3),VRT(3),
               VRTT(3),SVORT(3),ORT(3),GAMDN(3,3),        GAMTN(3,3)
              ,GAMRN(3,3),AWRTA(3),OA(3),OT(3),VOA(3),        OWRTA(3),
        XTXR(3),XTXRT(3),RCLS(3),RCLST(3),SRCLST(3),RWRTT(3),AWRTT(3),
        VOT(3),VORT(3),VWRTT(3),OWRTT(3)
        EQUIVALENCE (RCG3(1),ADD(1)),(GAMAN(1,1),GAMA11),(GAMEN(1,1),
                  GAME11),(GAMRN(1,1),GAMR11),(T(40),OR(1)),(OA(1),T(7))
                 ,(OT(1),T(10)),(GAMDN(1,1),GAMD11),(GAMTN(1,1),GAMT11)
                 ,(RCLS(1),ADD(1)))
        COMMON/GUTN/XAXR,RVT,XTXR
        COMMON VAR
        COMMON/RET/ILOSS
        COMMON/TRANS/  GAMA11,GAMA12,GAMA13,GAMA21,GAMA22,GAMA23,GAMA31,
         GAMA32,GAMA33,GAMT11,GAMT12,GAMT13,GAMT21,GAMT22,GAMT23,GAMT31,
         GAMT32,GAMT33,GAMR11,GAMR12,GAMR13,GAMR21,GAMR22,GAMR23,GAMR31,
         GAMR32,GAMR33,GAME11,GAME12,GAME13,GAME21,GAME22,GAME23,GAME31,
         GAME32,GAME33,GAMD11,GAMD12,GAMD13,GAMD21,GAMD22,GAMD23,GAMD31,
         GAMD32,GAMD33,GAMC11,GAMC12,GAMC13,GAMC21,GAMC22,GAMC23,GAMC31,
         GAMC32,GAMC33,GAMP11,GAMP12,GAMP13,GAMP21,GAMP22,GAMP23,GAMP31,
         GAMP32,GAMP33
        ,GAMS11,GAMS12,GAMS13,GAMS21,GAMS22,GAMS23,GAMS31,GAMS32,GAMS33
        COMMON/INITAL/ARM1,TIMEPP,IPULL,JTEST4,SLOPE
         ,PROBEA,TLSA,II,IKA1,THESH1,CONST
        COMMON/ANGLE/STHA,CTHA,SPHA,CPHA,SPSA,CPSA,
                  STHT,CTHT,SPHT,CPHT,SPST,CPST
        COMMON/IHARD/ILATH,RP2,XL4,RP3,XL3,FLATCH,TLATY,TLATZ,THU2,THU3
        COMMON/RECAL/S
        COMMON/CALCU/FG,FC,F1,TOR1,FS1,FS2,FS3,FCR1,FCR2,FCR3,ETA1,
         ETA2,ETA3,FRT1A,FRT2A,FRT3A,TLS1,TLS2,TLS3,FRT1B,FRT2B,FRT3B,
         VELB1,VELB2,VELB3,VELP,FRICP,FRC1,FRC2,FRC3,PROBEL
        COMMON /LOG/YARM1,YARM2,YARM3,XLCB1,XLCB2,XLCB3
        COMMON/FORC/FSUMAX,FSUMAY,FSUMAZ,TSUMXA,TSUMYA,TSUMZA,TSUMXT,
         TSUMYT,TSUMZT,FSUMTX,FSUMTY,FSUMTZ
        COMMON/OUT/FOX,FOY,FOZ,TORX,TORY,TORZ,STRB1,STRB2,STRB3,STRPR,
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      FCX,FCY,FCZ
      COMMON/FULL/RETRAC
      COMMON/IOU/IONT
      COMMON/ERR/THAPE,PHAPE,PSAPE,THTPE,PHTPE,PSTPE
      COMMON/HARDFT/HARDXA,HARDYA,HARDZA,THRXA,THRYA,THRZA
      COMMON/ADDNEW/ADD
      COMMON /ADDLF/ ALF(50)
      DIMENSION ABB(10),ORD(10),SBB(10),COB(10)
      EQUIVALENCE (ALF(01),ABB(1)),(ALF(11),ORD(1)),
                  (ALF(21),SBB(1)),(ALF(31),COB(1)),
                  (ALF(41),ITSPO), (ALF(42),JNB)
      COMMON/ATTACH/AJ,AK,TJ,TK,FA,ATTNO,STR,ATTN,TH1,TH2,ATTNO
      ,ATTNX,ATTNY,ATTNZ
      COMMON/EFLEX/TIME,DX(150),ADDE(1000)
      COMMON /ANGLER/STHR,CTHR,SPHR,CPHR,SPSR,CPSR
      COMMON/FORCR/FRX,FRY,FRZ,TRX,TRY,TRZ
      COMMON/TRANR/GR11,GR21,GR31,GR12,GR22,GR32,GR13,GR23,GR33
      COMMON/TIM/TIMED
      DIMENSION TRTA(3,20),OFIN(3,3,4),R3A(3,4),R3T(3,4)
       ,R3F(3,4),RS(3,4)
      DIMENSION TAI(3),TTI(3),TAIC(3),TTIC(3),RCON(3)
      COMMON/STRV/TRT(3,20)
      EQUIVALENCE(C(23),RSX),(C(24),RSR)
      DOUBLE PRECISION TTL1,TTL2
      COMMON /TITLES/ TTL1(6),TTL2(6)
      COMMON /CA/ VCABR(3,10),VCABB(3,10),CABL(3,10),FCAB(3,10),
                 THOTOR,FCABM(10)
      EQUIVALENCE (D(20),XCR),(D(21),CRADB),(D(22),CRADR),(D(17),XB)
      COMMON /FRCE/ CONTX(9,6),CONRX(9,6),IFRCE
                 ,DELST(10)
      EQUIVALENCE (SKS,C(9))
       DIMENSION DUMM(10)
       COMMON /DUMMY/ ANXA,ANYA,ANZA,COMPHA,CONTHA,COMPSA,
                 ANXT,ANYT,ANZT,COMPHT,CONTHT,COMPST
       COMMON /SAVC/ SAVD(302,15),SMAX(15),IDX(15)
       COMMON /REST/ CPHAD,CTHAD,CPSAD,CPHTD,CTHTD,CPSTD,
                 ANXR,ANYR,ANZR,CPHRD,CTHRD,CPSRD,
                 RMRTA,RMRTT,VMRTA,VMRTT,AMRTA,AMRTT,
                 OMRTA,OMRTT,IPRNT,JPRNT,JPLOT,
                 DUMM,FL1X,FL2X,FL3X,FL1Y,FL2Y,FL3Y,FL1Z,FL2Z,FL3Z,
                 ANGL,R3F,TAI,TTI
       COMMON /MRL/ TORQ(3,8)
       COMMON/OVIEW/CON1,CON2,CON3,CTR(3,40),CTRT(3,20)
       DIMENSION FLX(4),FR(4)
       DATA PI/Z41324
3F7/,AVS/Z40C90FDA/
333    FORMAT(7H OUTPUT,10E18.4)
13     FORMAT(1H1)
300    FORMAT(40X    ,' NO ATTENUATORS =',I3,// )
305    FORMAT(1H ,//)
310    FORMAT(30X,'***** ADD - ARRAY ****  ',//)
3000   FORMAT(1H ,10I10//)
3001   FORMAT(1H0,8E18.8)
400    FORMAT(1H1,/ ,30X,30H **** INITIAL CONDITIONS ****  )
410    FORMAT(30X,14H       CASE NO.6A8//)
401    FORMAT(50X,15H ACTIVE VEHICLE//)
1000   FORMAT(3X7HOMEGXA E16.8,3X3HPHA4HE16.8,3X8HOMEGYA1HE16.8,3X3HTHA4H
       E16.8/3X8HOMEGZA1HE16.8,3X3HPSA4HE16.8,3X3HXAD4HE16.8,3X2HXA3HE16.
       8/3X3HYAD4HE16.8,3X2HYA3HE16.8,3X3HZAD4HE16.8,3X2HZA3HE16.8/3X3HOM
       A4HE16.8,3X4HXX1A3HE16.8,3X4HYY1A3HE16.8,3X4HZZ1A3HE16.8/3X4HXY1A3
       HE16.8,3X4HXZ1A3HE16.8,3X4HYZ1A3HE16.8,3X5HOFFJA2HE16.8/3X5HOFFKA2
       HE16.8,3X2HRAS3HE16.8///)
400    FORMAT(50X,15H TARGET VEHICLE//)
1010   FORMAT(3X8HOMEGXT1HE16.8,3X3HPHT4HE16.8,3X8HOMEGYT1HE16.8,3X3HTHT4
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FOLDOUT FRAME 1

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         [illegible]E16.8/[illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         16.8/[illegible]E16.8,[illegible]E16.8,[illegible]E16.8, [illegible]   E
         16.8/[illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]E16
         .8///)
408      FORMAT(48X,' C-ARRAY/ ATTENUATOR DATA '/  )
1020     FORMAT(1H ,8E16.8)
1000     FORMAT(1H /)
402      FORMAT(1H ,//,50X,'  D - ARRAY '// )
1030     FORMAT(1H ,8E15.6)
411      FORMAT(50X,17H PROGRAM COMMANDS//)
1040     FORMAT(3X,7H1PHASE I10,[illegible]E16.8,[illegible]  E16.8,[illegible]
         E16.8/ [illegible]GRAPH I10,[illegible]E16.8,[illegible]  E16.8,
          [illegible]I10/
         [illegible]PLOT[illegible]I10///)
413      FORMAT(50X,17H INTEGRATION DATA//)
1050     FORMAT([illegible]  E16.8,[illegible]I10,[illegible]E16.8,[illegible]E16.8/
          [illegible]I10,[illegible]E16.8,[illegible]E16.8,[illegible]E16.8/
         [illegible]E16.8,[illegible]E16.8///)
400      FORMAT(48X,24H REACTION CONTROL SYSTEM//)
1000     FORMAT(45X,24H   ACTIVE CONTROL SYSTEM//)
1060     FORMAT([illegible] E16.8,[illegible] E16.8,[illegible] E16.8,[illegible]
         [illegible]E16.8/[illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         [illegible]E16.8/ [illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         16.8/[illegible] E16.8,[illegible] E16.8,[illegible] E16.8,[illegible]
         16.8/[illegible]REACTA E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         [illegible]E16.8/[illegible]I10  ,[illegible]E16.8,[illegible]E16.8,[illegible]
         E16.8/[illegible]REACT1AE16.8///)
1090     FORMAT(45X,24H   TARGET CONTROL SYSTEM//)
1070     FORMAT([illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         E16.8/[illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         16.8/[illegible]E16.8,[illegible]E16.8,[illegible] E16.8,[illegible]
          E16.8/[illegible] E16.8,[illegible] E16.8,[illegible] E16.8,[illegible]
         MT E16.8/[illegible]REACTT E16.8,[illegible]  E16.8,[illegible]  E16.8,[illegible]
         NZT  E16.8/[illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         16.8/[illegible]E16.8,[illegible]E16.8,[illegible]E16.8,[illegible]
         I10/  [illegible]I10
         ,[illegible]REACT1TE16.8///)
4000     FORMAT(//,40X,31H SIMPLIFIED INITIAL CONDITIONS //,[illegible]E16
          .8,[illegible]E16.8,[illegible]E16.8,[illegible] E16.8/
          [illegible]E16.8,[illegible]E16.8,[illegible] E16.8,[illegible]AXIAL
          E16.8/[illegible]  E16.8,[illegible]  E16.8//)
4001     FORMAT(//,40X,31H STABILITY PARAMETERS OF HUNT  //,[illegible]  I10,
          [illegible]E16.8,[illegible]E16.8,[illegible]E16.8/
          [illegible]E16.8,[illegible]E16.8//)
96       FORMAT(//1H 47X,'RETURN ORIFICE AREA TABLE'/)
97       FORMAT(  /,47X,' STROKE VS AREA TABLE  '/  )
98       FORMAT(//1H 47X,'ATTENUATOR SPRING LOAD TABLE'/)
99       FORMAT(4(1XE15.8,5X,E15.8)
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LOCATIONS OF PRIMARY FUNCTIONS

The following is a list of primary functions and their locations in the program. Purpose of the list is to aid the user in locating possible modifications.

Function	Subroutine
Basic docking system geometry	FORCE 1, FORCE 3 OUTPUT
Attenuator hydraulics	SHOCK
Guide loads	FORCE 1
Attenuator forces	FORCE 1, FORCE
Ring loads	FORCE 1
Latch loads	FORCE 1, OUTPUT
Retract system equations	FORCE 3
Vehicle control systems	RCS
Basic equations or motion	MAIN, MASTER
Integration	MASTER, DERFUN
Graphs	GRAPH, PNTCRT
Print	OUTPUT, OUTPT

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